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[OFFICIAL NOTICE.]

Twenty-fourth Annual Meeting, Western Gas Association.

WESTERN GAS ASSOCIATION,
OFFICE OF THE SECRETARY,
NEW ALBANY, IND., April 8, 1901.

To the Members of the Western Gas Association: The 24th annual meeting of the Western Gas Association will be held in Louisville, Ky., May 15, 16 and 17, 1901, and will be called to order by the President, Mr. Ira C. Copley, of Aurora, Ills., at 9:30 A.M., Wednesday, May 15th.

The Galt House has been selected as headquarters, and the meetings will be held in a suitable room contained therein. The following rates have been obtained: European plan, $1.50 to $2 per day; American plan, $3 per day. Rooms with bath, from 50 cents to $2 per day, according to location. The Louisville Hotel offers similar rates. Sealbach's Hotel, European plan, $1 per day. It is especially suggested that those proposing to attend the meeting write well in advance for hotel accommodations, in order that certain comfort may be secured and assured.

The Executive Committee has arranged for the presentation of the following papers:

"Recuperative Furnaces of To-day: Directions for Operating and Testing;" by Mr. W. E. Steinwedell, Belleville, Ills.

"Six Months' Experience in the Operation of Inclined Retorts;" by Mr. A. H. Barret, Louisville, Ky.

"Taxation of Gas Companies;" by Mr. George McLean, Dubuque, Ia.

"Method of Keeping Prepayment Meter Accounts;" by Mr. Ernest Wm. Bell, St. Louis, Mo.

"Gas Association Libraries;" by Mr. F. H. Shelton, Phila., Pa.

"A Stormy Experience;" by Mr. John Gimper, Galveston, Tex.

"Gas and Hygiene;" by Mr. James Ferrier, Columbus, Ga.

"Wrinkle Department;" edited by Mr. F. H. Shelton, Phila., Pa.

"A "Short Topic" on the subject of "Isolated Generators for Bench Firing;" by Mr. Henry L Doherty, Denver, Col.

Reports will be received from the Conference Committees on "Municipal Ownership" and the "National Bureau of Advertising."

The Western Passenger Association (from points in Eastern and trans-Missouri territories), the Central Passenger Association, the Trunk Line Association and the Southeastern Passenger Association have granted rates of 1 and ⅓ fare for the round trip, conditional on 100 certificates being presented to the Secretary for indorsement. The territory embraced by the above Associations includes all States east of the Mississippi river, except New England. The following States and Territories west of the Mississippi river are in the territory covered by the Railway Association granting reductions: North Dakota, South Dakota, Minnesota, Wisconsin, Iowa, Missouri, Nebraska, Kansas, Oklahoma, Indian Territory, Colorado and Utah.

All persons attending the meeting will purchase a first-class ticket at starting point, paying full fare for same, obtaining from agent a certificate stating that the person whose signature appears on same has purchased, at full tariff fare, 1 first class ticket to Louisville, which certificate, after it has been signed by the Secretary of the Association, and a representative of the above Passenger Associations, will entitle the purchaser to a ⅓ rate returning home.

Apply to ticket agent at least 30 minutes before departure of train. All station agents do not have a supply of certificates, but they can be obtained by request, if notification is made in time. Persons outside the territory embraced by Passenger Associations mentioned above should purchase a ticket to nearest point within one of said Association, and from there purchase a ticket to Louisville, obtaining a certificate, which will, if properly indorsed in Louisville, entitle them to ⅓ fare returning to place from which certificate was obtained, provided it is indorsed by a representative of the Passenger Associations (who will be present at the meeting) and the undersigned.

Those who live in Western Passenger Association territory should consult local agent several days in advance of purchasing ticket to Louisville, in order to reach an understanding with the different roads as to the junction point via which they will make rates applicable. Some local agents sell to junction points, where delegates can re-buy to destination. Certificates held by wives of the delegates attending the meeting will be honored in the same manner as those held by the delegates themselves.

Tickets can be purchased under the above arrangement on or after May 11, and are good, returning from Louisville, on or before May 21.

A banquet, to be provided by the Association, will be held Thursday evening, May 16, at the Galt House, tickets for which will be sold at $5 each. As it is necessary that arrangements for this banquet should be perfected at an early date, it is requested that those who expect to attend the meeting will notify the Secretary as early as possible of the number of tickets they will require. While the ladies will not participate in the banquet, ample arrangements will be made for their entertainment.

The calling of the roll this year will be omitted. Every member attending will deposit, upon entering the meeting room, a special card which will be furnished him, and upon which he will write his name and address.

For the first time we are to meet in a city where the local gas company has in successful operation inclined retorts, which fact alone will be instructive and add to the interest of the meeting.

All queries sent to the Secretary for the Question Box will be assigned, in advance of the meeting, to members for answer.

The Secretary will be pleased to answer any communication pertaining to the meeting, and will mail blank applications to any who desire to become members of the Association. JAS. W. DUNBAR, Secretary.

LIBRARY OF CONGRESS
APR 30 1901

[Special Editorial Correspondence.]

Third Annual Meeting, Southwestern Gas, Electric and Street Railway Association.

HOUSTON, TEXAS, April 22, 1901.

Dear JOURNAL: The Third Annual Session of the Southwestern Gas, Electric and Street Railway Association was called to order, at 10 A. M. of the 19th inst., in the Milby Dow Hall, this city, by the President, Mr. J. F. Strickland. That clever gentleman had the satisfaction of welcoming a large attendance. The weather conditions were perfect; the cool, bracing atmosphere harmonizing well with the tinting of a true-blue Texas sky. The business sessions were opened by an "official reception" from the authorities of Houston, whose welcoming message was to have been delivered by the Mayor. A convention of the Mayors of Texas, however, was in progress at San Antonio, so the Association's welcome was spoken by only "an Alderman;" but it was, nevertheless, well spoken and heartily received—the very same "Mayor's meeting" kept Mr. E. H. Jenkins, of San Antonio, from the Southwestern's gathering, for "Ed." had to act as the Mayors' host in "San Antone." President Strickland's reply to the welcome was brief, witty and bright. After it came the regular order. That the Association will grow was shown by the election of 16 new members. President Strickland's address was a commonsense, practical paper, but I fear it will not appeal very forcibly to the minds of gas men; for of such Mr. Strickland is not. Some ordinary routine business was disposed of, and then came a disappointment, in that the promised paper, by Mr. C. A. Newning, Editor of the *Southern Industrial and Lumber Review*, on the topic of "Association between Meetings," was not forthcoming. He sent a letter of apology, though, in the lines of which he said quite something on the matter indicated. The other papers set for the first day came along in good shape, and frequent dips into the Question Box kept the technical work going ahead satisfactorily. The "gas questions" were numerous, many of which were undoubtedly prompted by the oleaginous state of the atmosphere, a result of the close proximity of the Beaumont oil fields. The sessions of the first evening were held in the Elks' Club rooms, and the paper by Mr. George Cushman, of San Antonio, on "Station Work," provoked the best discussion of the meeting. At the close of the session a rejuvenation of the "Sons of Jove" was announced to take place forthwith at Sangerbund Hall, when in due time 16 "sons" were "created" amidst spectacular solemnity and hilarious mirth. The most picturesque figure in the procession was the towering form of our genial friend Guldlin, of Hoosierdom. His signals of distress were promptly answered by old friends who offered such consolation as an elegant lunch with ample liquids could afford. The visit to the various plants yesterday afternoon, by the courtesy of Mr. H. F. McGregor, of the Houston Street Railway Company, proved an instructive and enjoyable excursion. At the power station the Beaumont oil is used as fuel under the boilers, with great satisfaction and much economy. The oil is fed by an automatic pressure pump, after having been heated to near 200° F., and is sprayed under the boilers by a steam jet. Mr. J. N. Fitzgerald, of the Houston Gas Company, showed the neatest gas plant in the Southwest, and we there were told how to make coal gas, water gas and Pintsch gas. At the morning session only one paper was on hand (that by Mr. E. L. Wells, of Marshall, Texas, on "What Are We Here For?"), but it brought out a good discussion. The officers chosen were: President, H. F. McGregor, Houston; First Vice-President, E. H. Jenkins, San Antonio; Second Vice-President, C. F. Yeager, Laredo; Third Vice-President, J. R. Cullinane, Denison; Treasurer, T. D. Miller, Dallas; Secretary, T. H. Stuart, Waco. The next meeting will be held in San Antonio next April, on dates to be subsequently named by the Board of Directors. The excursion to Galveston was much enjoyed. The meeting was in every sense an enjoyable one and its results are bound to yield fruitfully for the benefit of the various interests that were represented.—M."

BRIEFLY TOLD.

OBITUARY NOTE, MR. GEORGE A. TARBELL.—We regret to have to report the sudden death of Mr. George A. Tarbell, of Dorchester, Mass., who died, of heart failure, in his hotel at New Haven, Conn., some time during the night of April 19th. He was in New Haven in connection with business matters for the Welsbach Company, which corporation he represented in New England since 1895. Retiring for the night (April 19th) in apparently his usual rugged, good health, in the morning he was found dead. Deceased had been in the employ of the Willimantic (Conn.) Linen Company in the days when Colonel Barrows was potent in that concern. When the Colonel was appointed General Manager of the Welsbach Light Company he selected Mr. Tarbell to supervise the Company's New York business, in charge of which he remained for several years. Later on he connected himself with a Boston interest, but on the formation of the Welsbach Commercial Company he became affiliated therewith; and in that service and in that of its successor (the Welsbach Company) he remained to the end. He was a man who made and kept friends, as a host of them in the East will readily testify. For the facts in this sad case we are indebted to the courtesy of Mr. Sidney Mason.

NOTES.—The Western Gas Construction Company, of Fort Wayne, Ind., has been awarded the contract for the generating and purifying apparatus for the new plant to be constructed at Traverse City, Mich. ——The proprietors of the New London (Conn.) Gas and Electric Company have made a concession in the selling rate of 10 cents per 1,000 cubic feet.

[Concluded from Page 610.]

PROCEEDINGS, SEVENTEENTH ANNUAL MEETING, OHIO GAS LIGHT ASSOCIATION.

HELD IN DAYTON, O., MARCH 20 AND 21, 1901.

SECOND DAY, MARCH 21—AFTERNOON SESSION.

A RESOLUTION OF SYMPATHY.

Mr. Butterworth—I wish at this time, with your permission, to introduce a resolution. We all know Mr. A. C. Humphreys, an honorary member of this Association, and in so honoring him we also honored ourselves. He has attended our meetings and participated in our deliberations, and we appreciate very much his kindly interest in our Association. We know also that he recently met with a most severe loss in the death by drowning of his two sons in the Nile river. The resolution I would like to offer, Mr. President, is this:

"*Resolved*, That the Secretary of this Association be, and he hereby is, directed to transmit to our honorary member, Mr. A. C. Humphreys, of New York, our deepest sympathy in the great affliction that has recently befallen him in the tragic and untimely death of his two sons."

The motion was carried by a standing vote.

AGAIN, THE QUESTION BOX.

The President—We will now take up question No. 9, which is as follows:

"What is the best manner of making service connections with a 2 inch street main?"

Gen. Harbison—The best way out of that is not to have any 2-inch mains, and if there are any such take them up, use them for service pipes, and put down a larger main. Our experience is that we cannot now afford to lay a 3-inch main, and miles of mains of that size formerly laid were removed from streets that were asphalted, during the past 5 or 6 years in our city, and we are using them for service pipes. We have tried to save every lineal foot of it with the least possible wastage and I think we have not 1,500 feet in our pipe yard today.

Mr. J. T. Lynn—There are many companies in Ohio, and more in the United States and in Europe, that do use 2-inch mains. Smaller companies, or those that have not quite as much money as Gen. Harbison's, and that are not quite so ably managed, have to use some 2 inch mains. The question, however, which we are discussing is the best manner of making service connections with 2-inch street mains and not whether a 2 inch main should or should not be laid.

Mr. Maxon—I have had some experience in tapping 2 inch mains, having been connected with one of the smaller companies, which, as Mr. Lynn said, may not have so much money as some larger ones. We use a deep-threaded split sleeve for that purpose very successfully, by means of which we find it possible to tap the main without weakening it too much.

Mr. J. T. Lynn—I have connected services to a few 2-inch, cast iron mains, and have always drilled a hole and tapped it just the same as any other sized main; that is, where the service was less than an inch. If larger, I think, it would be advisable to put on a split sleeve or something of that sort. In the case of a wrought iron pipe, we did our tapping with a diamond point, cutting out a hole and then threading, which gives us a little more surface for the thread than if you drill it out. It does not cut away the iron so much. If you have a 1-inch or 1½-inch pipe then I would put on a split sleeve.

Gen. Harbison—How large have you been able to tap it without the use of a sleeve?

Mr. Lynn—Three quarters of an inch, into a 2-inch main.

Gen. Harbison—Driving a pneumatic, tired buggy over it would be apt to break the main I should think.

Mr. J. T. Lynn—Well, I have tapped a good many hundreds of them, and if a wanted an inch service in a house—we don't run less than an inch—I would make my tap three quarters and put in a short nipple.

Mr. Maxon—I always thought it rather weakened the pipe and that it was preferable to use a sleeve. I have made a great many more taps by the method which Mr. Lynn suggests than by means of a sleeve. However, lately I have been using the sleeve altogether.

The President—Have you had any trouble with them?

Mr. Maxon—In a few cases where the mains were shallow.

Mr. J. R. Lynn—You have mains break where there are no taps at all in a few cases. I am unfortunate enough to have some 2-inch cast iron mains, and do not put anything smaller in than 1¼-inch service,

but I keep a lot of special service ells with a 3-inch male and 1¼-inch female end, using a ¾ tap in the main.

Mr. Coombs—We have no 2-inch cast iron pipe, but have some 2 inch wrought iron pipe, and when we have to exceed a ¾ service, we cut our line in two and place a "T" for 1-inch or 1¼ inch service. A 2 inch wrought iron pipe will take care of ½-inch tap, but above that size on a 2-inch line, I should think it too much altogether. I don't think a satisfactory connection can be made with a 2-inch line by a tap more than ½ inch, but on the latter it will be all right.

Gen. Harbison—I must apologize to this Association for the number of times I find myself on my feet, and I want that apology to stand right before me all the time. We have been complimented over in Connecticut by the statement that we have lots of means back of us. This is true. And how have we gotten it, Mr. President? In 1849 our works were started and perhaps 2 miles of 2-inch cast iron pipe were laid as mains in various places. There isn't a living foot of that used as mains now, and we have had to change some of it at least 4 times, because a larger pipe was needed in the street, as houses were built and people would use more gas as prices came down, and a 2-inch main would not supply them. Finally, after the fourth relaying, we found it was economical to put it in as service pipe and that is the way in which we have made our wealth, by getting a sufficient supply of gas. When you get to talking about putting on jackets and split sleeves, and that sort of work, you are adding to your expenses more than the difference of cost. The labor is no more. Simply increasing the expense in the cost of the pipe. Is there any gentleman here who lays 2-inch mains in his streets? If so, I would advise him to take them out at the very earliest possible moment. My attention was called to this matter years ago by no less an expert than Mr. William Runkle—there are not many men in this country more experienced in the detail work of a gas plant than he is. He said no company could afford to put down less than a 3 to 4 inch pipe for street mains, and it was only in exceptional cases that one could afford to use those sizes. In these days when we are struggling to ascertain how we can increase our output, we shut it off by encouraging the use of a little main not big enough for service pipe for a good sized apartment block. That is our experience, sir.

Mr. J. T. Lynn—I also apologize for talking so much, but Gen. Harbison doesn't seem to understand that the question is as to the tapping of a 2 inch main, and not as to whether we should use such a main. We are all of his opinion that it is not good practice to place 2 inch mains, except at street ends, etc., or something of that kind. The question before us is, "How to tap a 2-inch main."

Gen. Harbison—I say it cannot be done satisfactorily.

The President—Question No. 16 is:

"Where is the best position for an exhauster?"

I will call on Mr. Andrews.

Mr. Andrews—Some of the members who discussed that question last night contended that the exhauster should follow the P. & A. tar extractor, if such an apparatus were in the works. In drawing the gas through the exhauster you get a better impinging effect on the different plates than you would if you forced it through.

Mr. Schwarm—We placed the exhauster between the hydraulic main and the P. & A. extractor. We carry our gas overhead, through a 12-inch main, to the exhauster, and before it gets to the P. & A. extractor it is almost free from tar, so that very little tar is taken out afterwards. We force the gas through the P. & A. extractor instead of drawing it through.

The President—Why did you so place it?

Mr. Schwarm—It was so placed when the works were built, long before I took charge; but I merely cited the fact that it works equally well.

Mr. Coombs—I believe the exhauster should be placed between the retorts and the first condenser, a good reason therefor being that the exhauster is under the control of the retort man and right next to the retort house. It works just as well after it leaves the retort house to have it there in close contact.

Mr. J. R. Lynn—It is not absolutely necessary to condense your gas before you get to the exhauster. A little warm tar will not hurt the exhauster; in fact, it will be a good thing for it.

Mr. Hayward—For the purpose of bringing it before this meeting, I will move that we now go into executive session.

The motion, being duly seconded, was carried.

On motion of Mr. S. F. Hayward, the Association went into

EXECUTIVE SESSION.

Mr. Persons—I have in writing a proposition to submit to the Executive Committee. It is as follows:

"We, the undersigned members of the Ohio Gas Light Association, hereby offer to the Executive Committee a proposition to amend Rule No. 10, page 5, of the constitution, so as to read that the annual dues shall be $4 per year, instead of $3 per year, as at present.—F. R. Persons, J. T. Lynn, B. E. Chollar, C. W. Andrews, T. C. Jones."

The President—The communication will be filed and submitted to the Executive Commitee. Under the constitution and by-laws of the Association it will have to go over until our next regular meeting.

Full discussion was then had on Question No. 13, which was as follows:

"What is the future of the vapor light for store lighting?"

In this connection the subject of the course pursued by the Welsbach Company, in the use of Welsbach burners on lamps other than gas lamps, was also fully discussed. Mr. Schwarm submitted the following motion:

That the Executive Committee of this Association be instructed to confer with the Insurance Underwriters of this State, and secure all the available statistics on the subject of the rates on buildings lighted by gasoline, by electricity, and by gas, and to make comparison along these lines; and, after a thorough investigation of the subject, they to furnish such information as they are able to obtain, to the gas companies throughout the State; and to get the law, now in force on this subject, couched in good, plain English, so that we may spread it broadcast among our consumers.

The motion was adopted.

On motion of Mr. Clapp the committee heretofore appointed on means of investigating the utilizing of waste heat from benches was continued.

On motion, Mr. R. Montgomery, of Youngstown, O., was relieved from the Committe on Electrolysis; Mr. George Light, of Dayton, O., was named to replace him, and the Committee was ordered continued.

On motion of Mr. Butterworth the open sessions of the Association were resumed.

Mr. Irvin Butterworth read the following

Report of the Nominating Committee.

To the Members of the Ohio Gas Light Association—Gentlemen: Your Nominating Committee beg leave to report the following names as officers of this Association for the ensuing year:

President—Mr. Henry L. Doherty, Denver, Col.

Vice President—Mr. C. W. Andrews, Hamilton, O.

Secretary and Treasurer—Mr. T. C. Jones, Delaware, O.

Members, Executive Committee, Messrs. F. W. Stone, Ashtabula, O., and Fred. R. Persons, Toledo, O.

Editor, Wrinkle Department—Mr. E. E. Eysenbach, Columbus, O.

Editor, Novelty Advertising Department—Mr. B. W. Perkins, South Bend, Ind.

Respectfully submitted, Irvin Butterworth, L. W. Wells, Charles H. Printz, } Committee.

Election of Officers.

On motion of Mr. J. T. Lynn the report of the committee was received and adopted, and the President was authorized to cast the ballot of the Association for the election to office of the members therein nominated.

Some Responses.

The President having announced the result of the election, Mr. C. W. Andrews, being called on for "remarks," said:

Gentlemen, I wish to assure you that I very highly appreciate this honor, which is not well deserved on my part, for I am a young member of the Association; but at the same time I will use my best endeavors to push forward the work of the Association as shown in its past, and which we hope to continue in the future. I thank you.

Secretary Jones said:

Mr. President and Gentlemen: I thank you very much for this renewal of confidence. If I have done anything to make this meeting profitable it has been a pleasure. I have a large, warm spot in my heart for the Ohio Gas Light Association, and I assure you that I will always do anything I can for its interests. (Applause.)

The following extract is taken from a letter received by the Secretary from President-elect Mr. Doherty, several days after the meeting:

I sincerely appreciate the honor done me by the members of the Ohio Gas Light Association in electing me their President for the coming year. It is needless to say that I shall do everything in my power to make the next meeting of our Association a pronounced success.

Votes of Thanks.

On motion of Mr. Andrews a vote of thanks was tendered the committee who had in charge the entertainment of the Association while

guests of the city of Dayton. The motion also included a vote of thanks to the officers of the Association for their efficient work in carrying on the seventeenth annual meeting to so successful a conclusion.

On motion of Mr. Schwarm a special vote of thanks was tendered to the Dayton Gas Light and Coke Company, to the Dayton Gas and Fuel Company, and to the Gem City Stove Works for the entertainment afforded the Association, and also the National Cash Register Company, for its generous placing of its assembly hall at the disposal of the members for a meeting place.

THE MATTER OF ADVERTISING.

Mr. Persons—I would like to ask if the Association cares to make any start in this advertising matter? It is a question that might be profitable to all of us.

Mr. Butterworth—Could you suggest some practical way in which we might start it?

Mr. Persons—The suggestion I would offer at this time is to establish an incipient bureau. For instance, here is a catalogue that has been brought to the attention of a number of the members of this Association which is one illustration of what can be done in the way of united action in advertising. Works of a similar kind could be gotten out in large quantities and distributed profitably, I think, among the various companies. If the thing could be started, I think it could be taken up with a great deal of profit. Since our meeting last year every Association that has made a start on these lines got the suggestion from what we endeavored to do at our former meeting. Acting unitedly we could do a great deal more of advertising for the same amount of money, and it certainly cannot help but be profitable.

Mr. Butterworth—Mr. Persons has made a practical suggestion, and I am in favor of doing something to bring about the establishment of a bureau as suggested by him, but I want to point out a seeming difficulty in the way of our entering upon the work very effectively at this time, and that is, as members of this Association, we are here in our individual capacities only and not as authorized representatives of our respective companies. We cannot pledge the support of our companies for the payment of money for this purpose—or at least many of us cannot—until we have had an opportunity of consulting with our directors. Otherwise we could vote to do it now.

Mr. Persons—It was not my idea to do it now, but to get in line for another year so that we could take decided action at that time. We could come at that time either loaded or unloaded to determine the matter one way or the other.

Mr. Stephens—I think it would be better to adopt something of this kind, than to raise the annual dues to $4. General Harbison brought this matter up. I have seen it worked successfully. I recollect when some few years ago I was put on a committee of another Association, the like question came up as to advancing the dues. There was only one way that most of the members thought the receipts of the Association could be enhanced, and that was to make each member pay so much additional each year. I suggested at that time that we get out an entertainment card, with local advertising on it, say every other page. The suggestion was adopted, the card was issued, and we made more money than we actually needed. Now it seems to me that this suggestion of Mr. Persons is a very good one. If the Association would take this thing in hand and charge each one for the advertising space which they occupied, the Association would have more money than it knew what to do with. I know it, because I have been through the mill.

Mr. McIlhenny—In connection with this advertising matter, it might be of interest to state the line adopted by the Association of the Edison Illuminating Companies; that is, the original licensee companies under the Edison patents. They have a very close and a very compact organization. One of their plans is that the various members, when they bring out new advertisements, or new forms of bills, or anything that would be of interest to the other members of the organization, these new forms are mailed to each member of the Association, so that all have copies of them. They print and distribute the first of each year a number of gummed blanks, with the names of different firms all printed upon them, and all the company has to do in sending out matter is to tear off the gummed blanks and paste them on the envelopes. This system has been very useful to the various members of the Association, and each one has the benefit of the new advertising ideas gotten up by other members of the Association.

Gen. Harbison—Mr. President and Gentlemen: Before you adjourn I will ask you to pardon me just a moment. I want to thank the Ohio Association, and every individual member, for the courtesy, kindness and fraternity with which I have been greeted and treated since I came here. I have traveled from my home here to meet the brothers, in anything but a good state of health, and I believe I have been benefited very much through being here. I wish I could see you occasionally at my own home. It would do me a lot of good, and it would not hurt you. When you come to New England do not fail to let me know as to where you are and let me have a greeting. These gatherings are of much benefit to us and to me, and I speak from experience. I have occupied a great deal more of your time and patience than I had the slightest idea I would do when I came here, for I expected to listen and to receive your cordial greetings and did not expect to be called upon to say anything. But I am constructed on the model, Mr. Chairman, that when anything comes up that will interest me or I think will interest my associates in business, to discuss it in all its phases, not for the sake of being heard, but for the sake of possibly giving a suggestion or, from what I might say, bringing out a suggestion from somebody else who knows more about it, that may be of practical value to us in our calling. Mr. President and members, I thank you. (Applause.)

Mr. Butterworth—Mr. President (if you will permit me) I think I express the feeling of every member when I say we are very glad to have Gen. Harbison with us. We appreciate the compliment he has shown us by coming so great a distance to be present at this meeting. We are all pleased to hear what he has said and we have derived benefit from his remarks and advice, which, as he admits, he gives so freely and so well.

The President—I think it is the unanimous opinion of every member of this Association that we have all received benefit from the suggestions which Gen. Harbison has given us, and on behalf of the Association I take pleasure in returning the thanks of the Association for the compliment shown us by him in being with us at this meeting.

Mr. Butterworth—I think, Mr. President, as Mr. Persons suggested, we should do something with this advertising matter. I, therefore, move that the matter be referred to the Executive Committee (which is a standing committee) with the request that they take this matter up and co-operate with the other Associations in devising some scheme of advertising by which we can all get effective advertising matter at low prices.

The President—Gentlemen, I wish to say I have enjoyed the meeting very much. We are to be congratulated on the hearty co operation of all its members, who have worked together to make this a most successful meeting. There has been no hanging back, and as far as I can see it has been a most profitable and pleasant meeting.

Mr. Butterworth—Mr. President, I agree with you. I think I have attended every meeting of the Ohio Association from the start to this, and the last I think is one of the best meetings we have ever had, which is saying a great deal.

On motion of Mr. Persons the convention was declared adjourned.

Lighting of the Cities of the Hawaiian Islands.—Possibilities for Development.

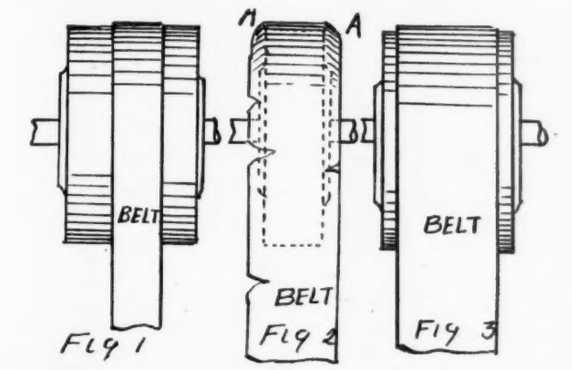
[Prepared for the JOURNAL, by "HONOLULU."]

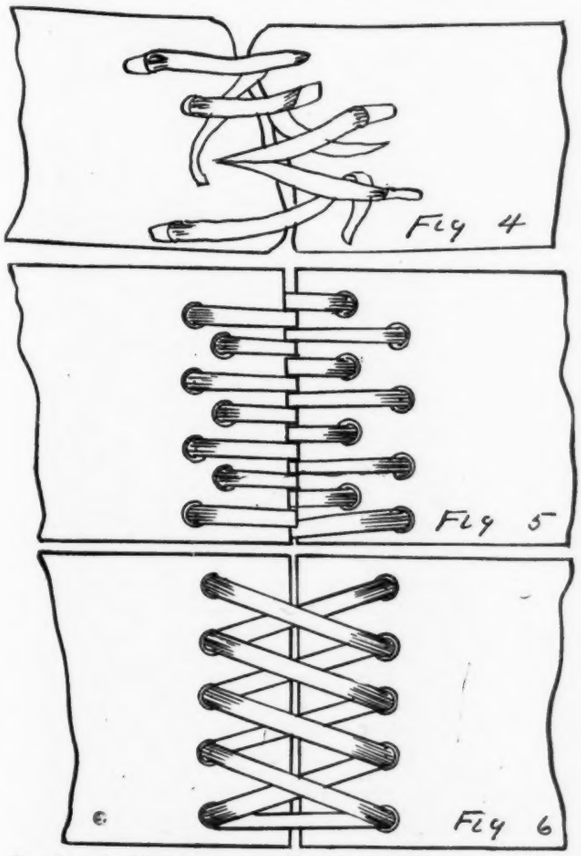
The writer recently visited the Hawaiian Islands and found there that considerable progress had been made in street and house lighting facilities since his last visit about two years ago. When I was here before they were putting in new power stations for the electrical lighting plant, which is now in very successful operation. There has been a good deal of talk about starting a gas plant, but the character of the coal secured from the mines of the islands does not at present warrant any important steps being taken in this direction for some time. Much coaling of steamships goes on here, and the vessel your correspondent was on was obliged to wait for a "turn;" but most of this coal is imported and the cost is high. Illuminating oils have been sent to the islands in vast cargoes, and the country is liberally supplied with oils for lighting purposes, for streets, homes, workshops, public buildings and offices; but the days of the oil lamp are numbered, even in the Hawaiian Islands, for electrical lights are fast being substituted. The electrical light has proved satisfactory to the people and they do all they can to encourage the enterprise.

Facilities.—Most of the electrical lighting plant had to be shipped from American shops to the islands, and often there were delays and annoyances before the lighting system was gotten into perfect running order. At first the people objected to the white, bright light, and some were prejudiced because it caused a reduced consumption of illuminating oils. The electrical light companies had trouble in getting their lamps installed in many places and the difficulties which had to be

overcome were numerous. One dealer in the new forms of electrical lights told me that, for the first period of the introduction of the electrical lighting system, many persons came to him and requested that he should not handle the "devil lights." The people seemed to fear the sparking lights, and, in fact, some of them would not permit the lights to be put up on poles near their residences; but these troubles are of the past, and to-day the electrical lighting system is well conducted.

Lack of Trained Mechanics.—I did, however, observe that some of the electrical and mechanical engineers in the service of the electrical companies were not as fully competent as they might be. Mostly American machinists are in charge of departments and sections, but the ordinary mechanical department is made up with a force of native machinists, fairly competent, but still lacking the facilities and training which make them the best of hands. In the annexed figures I show





Some Imperfect Belt Settings on Electrical Lighting Machinery in Honolulu.

some of the imperfections in power systems resulting from ignorance on the part of the men.

I saw that one of the dynamos in one of the power stations was doing poor work. The power seemed to be short. I examined this machine and found that, instead of a wide belt being used, which would grip the driving pulley properly, a very narrow belt was used, like that in Fig. 1, and at every turn of the wheel there was slippage and loss of power. I asked the machinists why this was so, and they stated that they supposed that the narrow belt would do the work. They, however, declared that they would shortly procure a properly sized belt, which I afterwards found out they did, and also ascertained that the machinery ran correctly thereafter. Mistakes of this sort, in setting up and belting electrical machinery, had proven very troublesome to builders of machinery in the United States. The machinery makers of England and Germany, who had previously furnished apparatus to the shops of Honolulu, had been smart enough to send men along with the machinery to set up, belt and properly adjust the machines, and also remained long enough to train the machinists of Honolulu in the proper system of working the devices. In one place I saw that the other extreme in belting had been reached, by the native machinists using a wide belt on a narrow wheel, as in Fig. 2. Here we have the form of the pulley represented by the dotted lines *a*, *a*. The belt is lapped over at the edges, owing to the extra width, and the edges are, in course of time, torn and broken, as shown. Such a belt cannot run steadily and accomplish effective work. This belt was afterwards removed and the edges trimmed down, and this trimming made the belt so narrow that it could be used with good results on the wheel. In Fig. 3 is shown the proper proportion for the belt for pulleys, the belt itself being a little less than the width of the pulley.

Honolulu Systems of Belt Lacing on Electrical Power Station Machines.—I found that some of the machinery used in the power stations of electrical lighting lines was belted up with leather belts which were joined at the unions very crudely, as shown in Fig. 4. These sorts of joints are bound to give trouble. The special instances in which I saw such work revealed the raggedness of the conditions, by the machinery driven by the same jumping and at times almost stopping, as the long, loose lap would touch the wheel. The edges of the sewing would catch the guides and make trouble. The bearing of the wheels would heat and grind and the troubles were quite general. I present in the next figure a face view of a belt properly laced for electrical power machinery, and in Fig. 6 the back of the same union, showing how the stitches are crossed and the ends closed.

As to General Lighting Facilities.—There are several houses in Honolulu that carry fairly good stocks of furnishings for lighting purposes. One can purchase lights and lamps, from the cheap oil light to the costly incandescent outfit, and all of most modern patterns. There are, however, no stores that make a specialty of furnishings for the electrical lights, and there is a very good opening for such a house. The hardware stores make an attempt at carrying lines of supplies for electrical machinery and lamps for all purposes. They also have wire, cables, cross-arms and various fittings for the putting in of lines of lighting systems. The lines now pretty well cover the territory about Honolulu and are being extended constantly. I saw that the poles were of domestic selection, most of them being poplar, of which there is a good supply on the islands.

The people are ready to adopt anything introduced by Americans nowadays, all of the old prejudices having worn away.

Electrolysis.—The Effect of Stray Trolley Currents.[1]

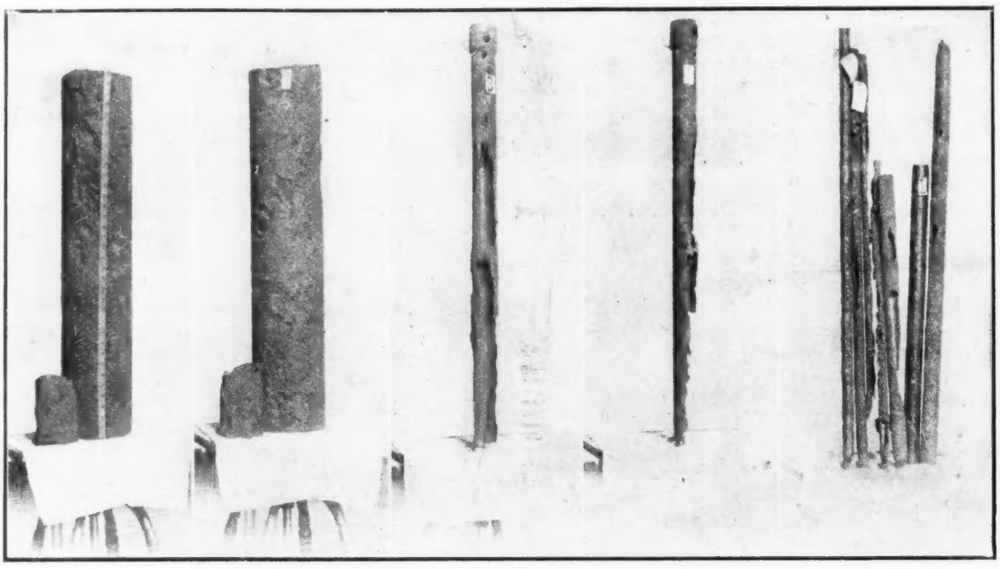
The Brooklyn (N. Y.) Union Gas Company, some three years ago, realized the necessity of an electrical department to deal, not alone with the questions of isolated electric lighting plants driven by gas engines, and gas for power in general, but that of electrolysis as well. Having charge of this department, I have been enabled to make observation and collect data, and to furnish herewith some results and conclusions appertaining to this element of destruction, to which all metal properties buried in the earth, under cities where the single overhead trolley system is in use, are liable.

It is just a century ago since Carlisle and Nicholson discovered that if a current be passed through water, by dipping in it the ends (electrodes) of the wires leading from a voltaic battery, that oxygen was liberated from the electrode (anode) into which was passing the positive current from the battery, and hydrogen was liberated from the cathode or electrode to which the wire from the negative pole of the battery was attached.

A step further showed that metals could be deposited from their solutions (electrolytes) upon the cathode; the anode, if of the metal itself (as in electroplating), suffering a loss in weight equivalent to that gained by the cathode. Faraday called the atoms of the electrolyte seeking the anode, anions; and those seeking the cathode, cathions.

Remembering that hydrogen and the metals are cathions, and that oxygen, chlorine, etc., are anions, let us pass on to our subject as it is found in practice, the foregoing being given to elucidate what is to follow.

1. By Mr. H. E. McGowan, in *Stevens' Institute Indicator.*



No. 1 No. 2. No. 3. No. 4. No. 5.

Views Showing Effect of Electrolysis on Gas Mains in Borough of Brooklyn, New York City.

No. 1.—6-inch cast iron main from foot of Fulton Street and East River. Iron, dark and very brittle, being easily broken in by tapping with a penknife in center of pittings. Here the gas mains are negative to the rails, but positive 1.16 volts to the river. The ground is low, the mains being in earth which is quite moist with the salt water. Removed, Jan., 1900. It will be noticed that the crater-like pittings are unlike those which occur in the case of wrought iron. The small piece shows a 3-inch cast iron main from Kent avenue, in the vicinity of a large power house. The iron was "gray." The main was 8 feet from the nearest rail, in good, dry soil, and positive, 2.4 volts to the rail.

No. 2.—Another view of No. 1, further around, showing holes in the 6-inch cast iron main. The iron at the edges of the holes is of wafer-like thinness. Oxidation of this sample since exposure has been practically inappreciable, while the 3-inch has flaked considerably, leaving the pitted surface as now seen in the cut.

No. 3.—1½ inch wrought iron service pipe from foot of Main street, supplying ferry house. Some 200 feet of this service were found in a condition of which this is a fair sample. A spur of track running down to the ferry was +2.25 volts to the service, this in turn being +.8 volts to the river, the low reading being due to the service lying practically in the water, thus cutting down an otherwise high voltage. Notice should be given the corrugated nature of the attacked wrought iron surface, in contrast to that of the cast iron, which is always studded with crater like depressions.

No. 4.—A side view of No. 3, to show what is left through which the gas company is expected to satisfy the consumer.

No. 5.—A raw recruit and a few veterans that have seen hard service.

In the case of gas and water pipes buried in the earth and corroded by stray currents from the trolley system, we have before us the conditions arising in an electrolytic cell of huge dimensions, in which the pipes appear as the anode, the rails as the cathode, and the moist earth the electrolyte—in the latter appearing the chlorides, carbonates, sulphates, nitrates, etc., of the alkali earths. Upon the passage of the smallest current these salts are split up, their acid radicals (O., Cl.), attacking and dissolving the anode (the pipes), while the metal, in trying to reach the cathode (the rails), is deposited in the neighboring earth, forming with it a scale of such toughness that often a rap from a sharp shovel is needed to dislodge it.

The weight of a metal deposited electrolytically from its solution is found from the equation

$$W = .0022\ Czt.,$$

where C is the current in amperes, t the time in seconds, and z the electro chemical equivalent of the metal. W is here expressed in pounds per t secs. From this it would appear that the voltage plays no part in the question; but, to the contrary, notwithstanding, we shall soon see.

In dealing with the subject in Brooklyn, a thorough test over the city was first made with a voltmeter to determine those localities where danger is imminent; that is, where the gas mains were positive to the rails.

Readings were made between the gas mains and rails, the mains and water system, and between the different gas systems themselves; these systems again between themselves and the rails, and water mains; also, between the water mains and the rails. That there are these different systems is due to the fact that the Brooklyn Union Gas Company, as the name implies, is a union (in 1895) of the seven companies then existing, their several sets of mains now being in some places intimately connected while in others they are still distinct, thus making an interchange of currents between them possible and explaining why destruction is met in places remote from streets where the trolley is rampant. Furthermore, readings were made all along the water front between the gas mains and the river at such points where the mains jutting down made connections possible.

Six power houses for the operation of the trolley roads make the problem still more complex; and when the readings of the voltmeter are plotted on the city's map—the plus readings in red and negative readings in black—these power houses will be found hubs in the neighborhood of which high red readings will be noted, these falling away until a circumference is reached where the sign changes to negative, the pipes here taking on the current (the rails themselves being now open to the ravages of electrolysis), to be again given up to the rails when conveyed within the circle mentioned above—again doing its work of destruction.

We here see where the voltmeter is indispensable although the actual cause of the trouble is the amperage.

Much has been written lately as to determining the amount of current carried by the gas mains, by "stripping" them and performing laboritorical investigations as to their conductivity, etc., etc.; all very well so long as the earth is not in contact with the main, but the first shovelful of dirt begins the interment of all this data as well as the pipe itself; for when the pipe is buried, who can say that all the current is still following the same path as when the experiments were made?

The vagaries of the subject are many; where the voltage is the highest, one need not expect the worst damage; in fact, after one has had the annoyance of a few unfruitful openings made where there is a high voltmeter reading, he will learn to pause and consider, first of all, such factors as locality—*i. e.*, whether above or below river level, whether on the approach to the slope or brow of a hill; the nature of the soil thereabouts, whether filled in land or otherwise—for the drainage is important; and the extent of traffic on the trolley line between the place where you suspect damage and the end remote from the power house.

It is our practice as much as possible to parallel the mains in those streets where the railroad operates; in other words, having a main on either side of the street, thus doing away with all long services which

would of necessity pass under the tracks, and, the conditions being favorable, be destroyed in a short time.

All service pipe (wrought iron) before introduction is coated with a paint the chief ingredient of which is coal tar to which rubber is added to keep the surface from cracking when the pipe is bent in handling; and this paint, while in no wise considered a cure for electrolysis, is of such good use that in certain localities where 2 inch wrought iron pipe lasted at best but 9 months, it is now down 2 years, and no trouble yet.

A palliative may be found in bonding the mains with the rails at points where the mains are positive to the rails, thus draining them of the current which otherwise would pass off into the earth; although a cry from the theorists goes up *in re* the high resistances of the joints in long stretches of cast iron mains, and the consequent tendency of the current to leave the pipe at the "bell," go round through the earth, entering again at the spigot, and so causing internal and external electrolysis at these joints.

But as is often the case practice repudiates theory; and we have in Brooklyn this condition: Five years ago in a certain section it was impossible to keep wrought iron services intact for 6 months; the mains were bonded to the rails at various points, and immediately opposite the power house an 8° copper wire was run to the negative bus. The wire was bringing in from 200–300 amperes, depending upon the time of day. Since this bonding 5 years ago we have had comparatively little trouble, where before we had so much—and, so far, the lead has not "run out of the joints," nor "caused explosions" of any kind; and if the former *were* the case, the value of the gas saved would more than offset the cost of recaulking. Bonding has also been resorted to in Long Island City with success.

There is no complete safety from the action of these stray currents, unless the trolley roads adopt either the double overhead or the underground systems, and unless they be driven to it by the hand of the law, or change from a realization of the saving to be made in their coal piles, or better, from a sense of duty to those corporations whose right, so far as the use of the cities' underground, is as good as theirs, so long will the gas companies' properties be in jeopardy, and life in danger from explosions due to escaping gas ignited by current. which should be confined in adequate return wires.

The Quantitative Estimation of Hydrogen Sulphide in Illuminating Gas.[1]

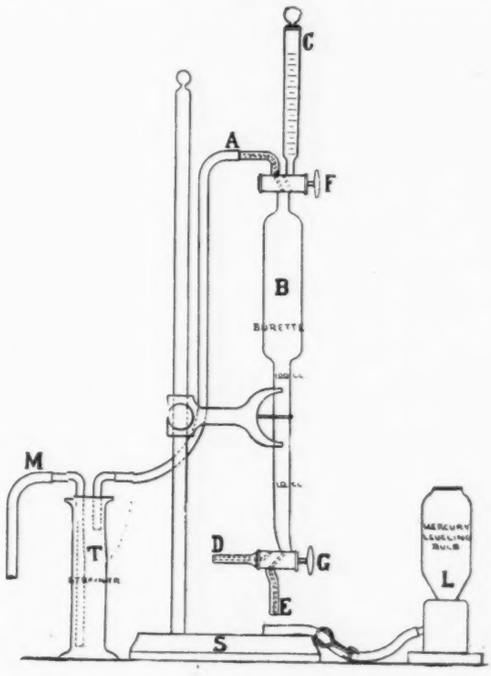
By Mr. C. C. Tutwiler.

In the manufacture of illuminating gas the importance of tracing the successive stages of purification of the crude gas from the time it leaves the retorts or water gas machine until it passes the purifiers is obvious, as by this means alone is it possible to determine the efficiency of the purifying plant and of the character of the raw material used, as well as the purity of the finished product. Tests on the purified gas are generally qualitative and are all that is necessary, as in most cities perfect freedom from obnoxious constituents is required by legislative enactment. This is particularly true of hydrogen sulphide on account of its exceedingly injurious products of combustion. The usual qualitative test for this impurity consists in allowing the gas to be tested to impinge upon a piece of moist lead acetate paper for a few minutes, any discoloration showing the presence of hydrogen sulphide. It is, however, of great importance at times to know the exact hydrogen sulphide content of the unpurified or partly purified gas, in order to ascertain the condition of the purifiers and the efficiency of the purifying material used. Boxes run in parallel present a ready means of ascertaining whether the work to be accomplished is equally distributed, or is being done wholly or in part by one set of boxes. In order to ascertain this it is necessary to make determinations at the inlet and outlet of the purifiers, and these, to be of value, must be made at practically the same time; hence the necessity for a rapid method of making the analysis.

The methods hitherto adopted in gas works have proved unsatisfactory on account of the slowness of the usual gravimetric estimations and the necessary manipulative skill required in making the determinations, besides a laboratory equipment not usually possessed by the smaller plants throughout the country. It was to overcome these difficulties that the apparatus about to be described was devised. Its action depends upon the well known reaction between hydrogen sulphide and iodine, according to the equation—

$$H_2S + I_2 = 2HI + S,$$

hydrogen iodide and free sulphur being formed. Although the suitableness of iodine for estimating hydrogen sulphide in illuminating gas was suggested by Bunte many years ago, it seems never to have come into general use, due possibly to the great care necessary to obtain accurate results with a Bunte burette. The apparatus used in the United Gas Improvement Company's works is shown in the accompanying sketch. It consists of a burette, provided at top and bottom with 3-way



stopcocks, and communicating at the top through one of the outlets with a 10 cc. glass stoppered cylinder graduated into 0.1 cc. There are only two graduations on the stem of the burette, one at the 100 cc. mark, the other 50 mm. from the bottom stopcock, dividing the remaining space into two divisions of about 5 and 10 cc. respectively. A mercury leveling bulb is attached to the lower stopcock at *E*, and the burette mounted on a stand as indicated. When analyses are to be made on crude gas a tar arrester, consisting of a wash bottle containing cotton, is placed between the gas supply and the burette. The manner of using the burette is as follows:

Turn both stopcocks so that *A* and *E* communicate with the interior of the burette. Connect gas supply to *A* or to *M*, if testing crude gas, and let gas flow through the burette and out at *E* for a few minutes, thereby displacing the air by the gas to be tested for hydrogen sulphide. Close the bottom of the burette by turning *G* so that *E* communicates with *D*. Close *F* and disconnect from the gas supply at *A*. Allow the burette to stand for a few minutes until the gas reaches the temperature of the surrounding atmosphere, which should be noted. Attach leveling bulb tube to *E* and raise the mercury bulb until the mercury passes into the stopcock *G*, thus removing air from the rubber tube and *E*. Turn the cock so that *E* communicates with the interior of the burette, and bring the mercury up to the 100 cc. mark, thereby compressing the gas in the burette. Close the lower stopcock and open *B* to *A* momentarily, in order to bring the gas in the burette to atmospheric pressure. Open *B* to *E* and draw the mercury back to *G*, closing the stopcock by turning so that *E* communicates with *D*. We now have 100 cc. of gas measured at atmospheric temperature and pressure, under a negative pressure. Place the clip on the rubber tube and remove the same from *E*. Take the burette from the stand and by opening *B* to *A* allow the partial vacuum to draw into the burette about 5 cc. of starch solution from a portion contained in a small beaker. Close the cock and fill the graduate with a standard iodine solution, noting the reading. Admit the iodine solution into the burette, gradually shaking between each addition of 3 or 4 drops. Continue until the starch paste assumes a permanent blue color. Note the reading on the graduate which, subtracted from the previous reading, gives the amount of solution used. This, being multiplied by the number of grains 1 cc. iodine solution is equivalent to, gives directly grains H_2S per 100 cubic feet.

Suppose, therefore, that 5.2 cc. of iodine were required to give the blue color and 1 cc. = 100 grains, then the amount of hydrogen sulphide would be 5.2 × 100 = 520 grains per 100 cubic feet.

1. *Am. Chem. Jour.*, March, 1901, p. 173.

The strength of the iodine solution used is generally such that 1 cc. contains 0.0017076 gram of iodine per cubic centimeter. One cubic centimeter of this will then be equivalent to 100 grains H_2S per 100 cubic feet of gas.

Precautions.—The following precautions are necessary:

1. For very accurate work, the starch solution should be previously treated with just enough iodine solution to color it faintly.

2. The blue color must not be confused with the opalescent milky appearance given to the solution by the separation of free sulphur.

3. For very accurate work, introduce correction for temperature and pressure, bringing the gas to 60° F. and 30 inches.

Extended use of the burette in our works has established its value beyond question as a quick and accurate substitute for the older methods. Very little skill is required in handling the apparatus, no more than can be acquired in a short time by anyone of average intelligence. It will readily be seen that any variation in the strength of the iodine solution introduces no error in a determination of the percentage of impurity removed by a given purifier; for example, if it was found that single tests of the gas, before and after leaving a purifier, showed 500 and 400 grains of hydrogen sulphide per 100 feet respectively, assuming that 1 c.c. of the iodine solution is equivalent to 100 grains, then the efficiency of the purifier is 20 per cent.; that is, it is removing 20 per cent. of the total hydrogen sulphide impurity. If a subsequent examination of the iodine solution showed that 1 cc. was equivalent to 110 grains of H_2S, the calculations on this basis would still show that the purifier was taking out 20 per cent. of the hydrogen sulphide in the gas, for instead of there having been 500 grains in the inlet gas, there would actually have been 550, and the outlet gas would have had 440, 110 grains having been removed or 20 per cent. of total content as before. Errors of manipulation common to both determinations are also eliminated.

Note.—Since the above article was admitted for publication a paper has been read by Mr. Carroll Miller, of Newark, before the New England Association of Gas Engineers,[1] giving in detail results of experiments on purification conducted with this apparatus. The employment of starch paste solution instead of mercury in taking the sample is, perhaps, an advantage, as it is easier to handle and does away with the necessity in very exact work for drying out the burette after each determination. In using starch paste solution the burette is previously filled with the same, and the sample of gas taken by allowing the liquid to run out down to the 100 cc. mark, having previously purged the connecting hose with the gas to be analyzed. A question as to the accuracy of the apparatus brought from Mr. Miller the opinion that 15 grains of hydrogen sulphide per 100 feet of gas could escape detection. Before the apparatus was put on the market it was tested and found to be susceptible to as small a quantity as 3 grains per 100 feet.

Coal Tar for Paving Uses.[2]

By Mr. Fred. J. Warren, Boston, Mass.

Coal tar is a generic term applied to those bitumens which are extracted from coal by various processes in the manufacture of gas and coke. Commercially the name is improperly applied to water gas tar. The nature of the tar varies as does the nature of the coal, and also varies with the processes employed in the manufacture of the gas or coke. The process of collecting the tar is to pass through a cold water bath all of the vapors produced by distillation and which come off the coal and the other materials used. The gas rises to the top of the water, a large part of the ammonia is carried off in solution in the water and the tar is condensed by the water and settles to the bottom of the water bath.

There is no known method of describing accurately the true condition of tars. It is proper to say that no two tars are identical in every respect, although many tars are identical in every essential respect. Variations also occur from the admixture with the coal in the process of distillation of greater or less quantities of oils of various classes used for the purpose of enriching the gas. The tars vary in the amount of bitumen which they contain within the limits of 60 and 92 per cent. They also vary largely in the percentage of oil which they contain and in the quality of the oil. The non-bituminous matter contained in the tar is generally carbon, which is synonymous with lampblack, and was, of course, hydrocarbon before hydrogen was eliminated by combustion. The carbon is insoluble in carbon bisulphide or in the lighter coal tar oils, while all of the bitumen is soluble in coal tar, benzine or naphtha. Petroleum light oil or carbon bisulphide does not furnish a perfect solvent for coal tar bitumen. The process of determining the amount of bitumen in a tar is to liquefy it further by the use of coal tar benzole, and all of the solution will pass through the filter paper except the carbon. About 2 per cent. of the carbon is so fine that it will go through the filter paper and will appear by this test as bitumen.

The study of the by-products of tar is a very interesting one, but is too voluminous to be touched upon in an article like this, which has more largely to do with cements or pitches manufactured from tar for use in the making of concretes.

Coal tar cement is a residue by distillation of coal tar. Hardness is produced in coal tar cements, as in other bituminous substances, by removing part of the oils contained in the bitumen, leaving the residue of the consistency desired. Flexibility is maintained by sacrificing a certain amount of the hardness. To make a cement or pitch of a given consistency, say the equal of asphalt cement at 78° F., or a standard asphalt paving cement, requires the removal in one case of 16 per cent. of the original oil, and in another as high as 52 per cent. The natures of the oils removed vary as greatly as do the natures of the residues left. One per cent. of oil taken from one tar will produce more hardening effect on the residue than will 1½ per cent. taken from another. The quantity of oil removed at any given temperature from various tars varies greatly. Using an inferior tar, a pitch or cement can be produced by distilling off the oil at a temperature of 200°, while using the most permanent tar in practical distillation requires a temperature of about 600°. The temperature at which coal tar cements can be produced can be reduced greatly by supplementing distillation by mechanical agitation, or by blowing superheated steam or hot air into the still. The character of the residue or cement left by distillation depends somewhat upon the process employed, even when dealing with a given tar.

With the above synopsis of what coal tar pitch or cement is, I would say that coal tar was, up to 1845, the waste product of the gas works. The process of making gas at that time was crude, and the coals used were of a more uniform grade than those used at the present time. Tar was first used in its crude state as a supposed adulterant of pine tar pitch, which was then used to a very limited extent for roofing. This use developed that the more coal tar bitumen was used the better was the roofing material. The development of 1845 to 1865 was almost entirely in building composition roofs, and for this purpose it was not realized that any great care was necessary in the selection or preparation of the material. Notwithstanding the imperfect methods adopted, the industry has grown to immense proportions, and the roofing industry furnishes by far the largest market for all of the coal tar products of the country, amounting to over 500,000,000 pounds per year, and giving employment to about 50,000 men. It has, therefore, not seemed necessary to the manufacturers of coal tar goods to adopt any of those methods in the preparation of their cements which have been so essential to the proper use of the asphalt bitumens, when applied to the building of concrete or asphalt pavements.

While vast sums of money have been spent in chemical research on the use of more than 2,000 by-products of tar, it is a sad commentary upon the manufacturers of tar cements that there is not one large established concern in the United States which maintains an efficient or modern laboratory, which alone will enable it to put on the market an even approximately uniform bituminous cement. In the sixties an effort was made to imitate the asphalt mastics of Europe, by producing an artificial asphalt mixture, using the coal tar cements to bind the particles of sand together. It should be borne in mind that all classes of concrete, whether asphalt cement, coal tar cement, or hydraulic cement used as a binding material, are in fact artificial stones. The durability of the work depends upon the selection of the cement as well as upon the selection of the mineral aggregates, whether sand or stone, and upon the skill and care displayed in mixing and laying. The cement is used to bind the particles of mineral matter together. The skill and experience displayed in the selecting of the cementing material and the selection of the mineral matter have much to do with the durability of the work. Unfortunately, those engaged in the building of tar concrete sidewalks had not given the matter much, if any, scientific consideration, and at the time the tar bitumens were extensively used no one had any accurate knowledge of the proper selection of the mineral aggregates. This condition, combined with the fact that no one engaged in the business carefully prepared the bituminous cements, led to disastrous failures in a very large proportion of all the bituminous concretes put on the market. It should be noted,

1. Am. Gas Light Journal, Vol. LXXIV., No. 9, p. 325.
2. In *Municipal Engineering.*

however, that the same methods, when asphalt was first used, led to almost equally disastrous results.

To what extent the tar bitumens are available for use in concrete structural work the writer is not yet prepared to say, but a few facts can be recorded. There are a few cases which exist to-day which show conclusively that when at their best tar concretes have developed a life greater than the longest life of any piece of asphalt work in this country under any condition of usage. This is because asphalt pavements, or concretes, have not been in use as long as the best tar concretes, but the writer has no doubt but that a properly selected asphalt bituminous cement will, under most conditions of usage, develop a greater life than can be developed out of the best coal tar cement under exactly similar usage. Asphalt is as generic a term as coal tar, and the name can be properly given to any natural bitumen of a gummy nature as found in nature, whether it be admixed with mineral matter of various classes, or is found in a relatively pure state. The nature of the bitumen found in the asphalts combined with mineral matter is as various as is the nature of the bitumen found in the tars, and experience and development have demonstrated the necessity of great care in the proper building of asphalt concretes or pavements.

When the same methods which are found necessary in the building of asphalt concretes are employed in the selection of the tars and in their preparation, it is possible to produce cements of as great uniformity as it is possible to produce when using the asphalts.

Tar cements as a class have the following advantages over asphalt cements as a class :

1st, greater adhesiveness ; 2d, greater waterproofing qualities ; 3d. greater ductility.

The best coal tar cements are inferior to the best asphalt cements in the following qualities :

1st. All of the oils contained in coal tar cements can be evaporated at relatively lower degrees of temperature, and are, therefore, shorter lived as affected by the sun.

2d. The best coal tar cement contains a shorter range of flexibility under atmospheric conditions than does the best asphalt cement.

While the above is true of the coal tars as a class, it is equally true that the best quality of tar can produce a cement for certain classes of concrete uses which is superior to the average grade of natural asphalt cement, and this is especially true as applied to the building of bituminous concrete sidewalks and of bituminous macadamized roads. In sidewalk work the writer knows of one piece of pavement which has been in satisfactory use for over 42 years, the bituminous material of which is coal tar bitumen, and he knows several isolated cases where the sidewalk has been in use for 25 years.

Coal tar will never displace the use of asphalt, for any advancement which takes place in the use of coal tar will also take place in the use of asphalt. The coal tars under a proper system of development are bound to furnish to the trade the cheapest cement available, and one which, if carefully handled, will produce concretes suitable for many uses, and which will last from 20 to 30 years. It will produce the cheapest good concrete which can be produced, but it is not possible of development to such an extent that it will produce a mastic which will stand intact for centuries. This is true of the asphalts, specimens of which are recorded as being found in the ruins of Babylon and the Tower of Babel 20 centuries after their construction.

The modern method of examining the bituminous material is to collect specimens of concrete which have shown long life, extract the bituminous matter and determine the percentage of bitumen and the temper as recorded by penetration machine and then separate the mineral aggregate into the various sizes of material. By carefully noting the conditions which exist in each specimen examined, and by examining a large number of specimens, a reasonably accurate conclusion can be drawn by a man of sufficient experience to enable him, with reasonable certainty, to duplicate the condition which he finds invariably exists in those particular specimens which have developed the greatest life.

A careful examination of the oils produced by distillation shows a relatively greater difference in their physical and chemical characteristics.

An examination of the residues produced with a view to developing their physical characteristics develops fully as great differences in the quality of the residues as exist in the quality, quantity and amount of volatile matter of the oils. But the writer would prefer to touch on the physical differences of the cements at another time.

Steam Boilers in Manufacturing Plants.[1]

There has of late been a considerable increase in the number of steam boiler explosions in manufacturing plants, some of which are among the most destructive on record. No great amount of public attention has been attracted to these catastrophies, for the reason that the world makes news very fast nowadays, and there is so much to fix the attention from day to day that a boiler explosion is soon forgotten, and indeed is rarely of more than local and strictly ephemermal interest.

Those curious in such matters, who will take the trouble to reason from cause to effect, will have no difficulty in discovering that the comparative frequency of boiler explosions at this time is due to the fact that under present conditions of general prosperity they are neglected, and even if known to be in bad condition the temptation to take the chances of running them literally to the breaking point is so strong as to be irresistible by those in charge of shops. It requires no small degree of moral courage to interrupt the smooth running of a shop which is full of profitable work, with more in sight, to replace an old boiler with a new one, or even to make necessary repairs which might prolong the life of the one in use. The fact that employers are often impatient of that kind of information makes foremen and superintendents cautious about advising the office when inconvenient repairs and replacements are necessary. In many cases the subordinate who should make himself disagreeable in speaking too freely about matters of which employers do not care to have too intimate knowledge would quickly make himself *persona non grata* to the management, and would stand a good chance of losing his job. We are all of us apt to believe what we wish to think true, and have very little use for information which imposes an obligation, legal or moral, which we are not ready to assume. There is reason to fear that too many steam users are just now displaying this unwise optimism as to their boilers. Every pound of steam which can be had is needed at the moment, and the requirement in busy shops is in many cases for more steam than the present boiler plant can furnish with safety. The fact that men can be had who will crowd them beyond their capacity makes it risky for one who values his employment to refuse to do so. If he is too communicative he is rated as a growler, his motives are misjudged, and he soon discovers that he is not employed as adviser to the company or firm, and not valued in that capacity. This leads most men to keep their observations to themselves, and it often happens that the office does not know what is known to every one in the shop, that the boilers are wearing out with dangerous rapidity, and that in their case what is likely to happen at any moment is not the unexpected, but the imminently probable.

It sounds very much like a platitude to say that no manufacturer can afford to take chances of this character. Moreover, it is unfortunately true that large profit has been made by taking just such chances. Boilers do not always explode when they should to vindicate prophecies based on indisputable evidence that they are not strong enough for the work they are doing. This is to be regretted, perhaps. If they did very few steam users would take the chances they now consider profitable. The trouble is one which cannot be reached by official inspection, which is too often unskillful or perfunctory. It cannot be corrected by the insurance system for two reasons : The business has been invaded by companies which take a larger speculative risk than was once considered legitimate, in view of the fact that the original view of boiler insurance was not that of a system of distributing losses, but one for averting explosions ; and that what the well managed companies decline in the way of risks the speculative companies are quite ready to accept. As the result we find boilers insured on the fire insurance principle of general averages and premiums high enough to pay losses enormously greater in proportion to the volume of business done than attended the boiler insurance business when its view point was different. Apparently, the trouble cannot be corrected by the enactment of laws holding boiler owners to a stricter responsibility in the matter of explosions. The enforcement of such laws is necessarily discretionary with courts and juries, and it is very difficult to erect into a crime what may have been, and is usually assumed to be, an accident. The matter resolves itself in the ultimate analysis into a question of moral responsibility. It is the duty of the steam user to do what he can to insure the highest attainable standards of safety, and to neglect it or perform it perfunctorily is a crime against life and property. The owner who voluntarily remains ignorant of the danger incident to the condition of his property is fully as responsible as if he had the information and neglected to act on it. Indeed, it would seem as if his moral turpitude was greater, since it shows cowardice as well as mercenary negligence. As the rule, such sins bring their own punishment in fuel waste and a general lack of efficiency in shop organization and operation, which offsets all the advantage gained by deferring repairs or replacements until dullness follows activity and losses are substituted for profits. These are considerations which manufacturers who are taking the chances with old, inadequate or structurally unsafe boilers may ponder with advantage.

1. *Iron Age.*

Mechanical Equivalent of Light.

By Mr. Carl Hering, in *Electrical World.*

Experiments recently made with an arc light which departs entirely from the principles common to all those heretofore used, are claimed to have shown an efficiency of 100 per cent. in the conversion of electric energy into light; that is, all the energy of current is claimed to have been converted into light.[1] That this cannot be correct, and that certain unallowable assumptions were made, will appear to those who have followed the description of the experiments, but it again brings up the question of the mechanical equivalent of light, what it is, and how it is determined. In view, therefore, of the fact that this novel, efficient and interesting lamp, although still of doubtful commercial value, may be experimented with by others, it may be of interest here to discuss the determinations of this mechanical equivalent of light made some years ago by Tumlirz and by Thomsen, and to reduce them to more convenient terms.

This mechanical equivalent of light, that is, the energy which is required to produce a unit quantity of light rays, is a figure not found in text books, and has heretofore been of comparatively little interest, for the reason that the best efficiencies which have been obtained in commercial lights have been so very low, that it was of little consequence to know how near the maximum possible efficiency they were. It sufficed to know that a really efficient commercial light was still unknown.

Another reason why this figure is not generally stated may be that it does not exist. There is no doubt that light is energy, since it is a form of vibration; if proof is necessary, it is found in the fact that a light may be and often is converted into heat, as shown, for instance, by laying a black cloth in the sunlight, which will change the light into heat and get much warmer than a white cloth, which reflects it. Much and perhaps all of the heat we receive from the sun is conveyed to us as light or something similar, which is then converted into heat on or around the earth. Moreover, light is known to be nothing more than electromagnetic waves, precisely of the same kind as the Hertzian waves used in wireless telegraphy, the only difference being that the wave lengths are very much shorter than those of the latter. The shortest electromagnetic waves of the Hertzian order which it has been possible to produce are a few centimeters long, while the lengths of the light rays are only one or two hundred-thousandths of an inch. According to Lord Kelvin, the period of vibration, or frequency, as we now term it, of light waves is between one four million millionths of a second and one eight hundred million millionths of a second. That Hertzian electromagnetic waves are a form of energy was shown by Hertz himself in an experiment in which he absorbed these waves by an apparatus in which they were converted into heat, which then manifested itself in the form of a deflection of the instrument, thereby indicating the presence of these invisible waves. Further proof is, therefore, not needed to show that light is a form of energy; nevertheless, there may not be a single mechanical equivalent of light, as there is for heat, because it may depend greatly on the color or composition of the light, that is, on the wave length, and there may, therefore, be a large number of different mechanical equivalents of light.

Nevertheless, it may be possible to determine an average value for the standard of light ordinarily used, and this is what Tumlirz endeavored to do. His experiments and those of Thomsen are the only determinations of this constant that the writer has been able to find in a hasty search. The former are described in three very long papers published in the Transactions of the Vienna Academy of Sciences in 1888 and 1889.[2]

In the first one he describes experiments with a platinum wire heated to a white heat by means of an electric current. He measured the radiation by means of an air thermometer especially constructed for this purpose, and also the total input of energy, from which he calculated the energy of the light. Taking the Hefner amylacetate lamp as a basis, he found that for the unit candle power there is radiated per second as light an amount of energy equal to 0 00326 gram calories, or about 140 gram centimeters, which reduced to electrical terms is about 0.0135 watt. He admits, however, that this is only a very rough approximation, and merely gives a general idea of this constant. His other determinations are better.

In the second paper he calculated a value of this mechanical equivalent of light from some earlier experiments of Julius Thomsen.[3] These are based on a unit of light consisting of a spermaceti candle consuming 8.2 grams of spermaceti per hour. The action of the light on a thermopile was compared with that of a glass sphere filled with water at 50° C., the radiation from which was calculated by Thomsen according to the Dulong formula. The result of Tumlirz's calculation was as follows: The amount of energy in the form of light which falls per second on a vertical surface of 1 square centimeter at a horizontal distance of 1 meter from the center of this flame, is equal to 5.6×10^{-7} gram calories. This reduced to electrical terms is 2.32×10^{-6} watts. Or in units of work, 0.024 gram centimeters per second, or 2.4×10^{-7} kilogram meters per second. These data will be discussed below, in connection with the reference to the original paper of Thomsen.

The third part of the Tumlirz article is the more interesting as it gives the results in definite and well known terms. In this determination he measured, by means of a specially constructed air thermometer, the total radiation from a Hefner amyl acetate lamp, including both heat and light, and then by means of a thermopile, the relation between the light rays and the total rays. From these two he determined the mechanical equivalent of light and obtained the figure 0.00361 gram calories per second, for the energy of the light emitted in a unit solid angle in a horizontal direction. The exact definition which he gives is somewhat encumbered by mathematical expressions and conceptions, but such accuracy in definition is hardly warranted by the possible accuracy of the experimental determination. The above is what he means, and it agrees with the results in the next paragraph.

He furthermore states that the amount of energy in the form of light which falls per second on a vertical surface 1 square centimeter at a horizontal distance of 1 meter from the center of the flame, is equal to 361×10^{-9} gram calories, or "$(1.226 \text{ milliamperes})^2 \times 1$ ohm." Assuming that a unit solid angle is one which at unit radius subtends a unit surface, and which, therefore, at 1 meter radius would subtend 10,000 square centimeters, the latter figure agrees with the statement in the preceding paragraph.

These figures may be reduced to the following forms, some of which may be more convenient than those given by Tumlirz. They are all based on the Hefner amylacetate lamp as the unit of candle power, and should there be a difference in the mechanical equivalents of light for sources of different color, then the present figures are limited to the color of that particular flame. Attention may here be called to the fact that while the mechanical equivalent of heat is expressed in terms of units of work, such as foot-pounds or joules, the mechanical equivalent of light is expressed in units of power, such as horse power or watts. Either may be, of course, reduced to the other by introducing a limited time.

The amount of energy in the form of light which falls on a vertical surface of 1 square centimeter at a horizontal distance of 1 meter from the center of the flame, being taken, according to Tumlirz, as 361×10^{-9} gram calories in each second, then, if expressed in units of power, as it should be, it is equal to 2.01×10^{-9} horse power (English), or 1.50×10^{-6} watts. Or, if expressed in units of heat or work in a limited time, it is equal per second to 3.61×10^{-10} kilogram-calories, or 1.53×10^{-7} kilogram-meters, or 1.105×10^{-6} foot pounds, or 1.50×10^{-6} joules.

An illumination of a meter candle is that produced on a surface normal to the rays, by a standard candle at the distance of 1 meter. The above figures, therefore, also represent the power in the light per square centimeter on an illuminated surface for each meter candle of illumination. A room $12 \times 15 \times 9$ feet, which is lighted so that the illumination which reaches the walls, ceiling, floor, is equal to about 10 meter candles—which is quite a bright illumination and enables fine print to be read with ease—would, therefore, require only 11.8 watts for light, if the efficiency were 100 per cent., or less than a quarter of the power in a single ordinary 16-candle power electric lamp. There is, therefore, room for improvement if the basis of these figures is correct.

All the above figures refer to the surface which is illuminated, and not to the source of light. To calculate all the power which emanates as light from a source, it is necessary to know the mean spherical candle power of the source, or the relation of this to the candle power in the direction in which the light was measured. The figure can, however, be determined as follows for a unit spherical candle power—that is, for a source which emits 1-candle power in every direction, or whose average spherical candle power is unity.

The original data were based on the amount of light in a unit solid angle. If this unit is the solid angle subtended by the unit surface at unit radius, then a complete sphere measures 4π or 12.57 solid angles in terms of that unit. This, multiplied by Tumlirz's figure for the unit solid angle, .00361 gives .0454 gram-calories per second per spherical candle. This is equal to 2.52×10^{-4}-horse power, or 0.188 watts; or, in

1. Digest, March 9, p 413.
2. Tumlirz Sitzungsbericht der Wiener Akademie der Wissenschaften, 1888, XCVII., II., p. 1525; same volume, p. 1627; and 1889, XCVIII., II., p. 826.
3. *Poggendorf Annalen*, 125, p. 348.

terms of units of heat or work per second, to 4.54×10^{-5} kilogram-calories, or 0.0193 kilogram-meters, or 0.139 foot-pounds, or 0.188 joules. One horse power could, therefore, produce about 4,000 spherical candle power, or 8,000 hemispherical candle power.

According to these figures (if the Tumlirz constant is correct) the maximum light efficiency obtainable would be about 0.188 watts per spherical candle, which corresponds to about 5.3 candles per watt, and in this form the mechanical equivalent of light given by Tumlirz may be compared directly with our present way of stating the efficiency of electric lights. If we assume the mean spherical candle power of an arc lamp to be 1 watt per candle, the light efficiency based on the Tumlirz constant would be about 19 per cent. That of the Nernst lamp at 1.5 watts per candle would be about 13 per cent.; that of incandescent lamps at 2.5 watts per candle about 7.5 per cent., or at 3 watts per candle about 6.3 per cent.

Tumlirz made a deduction from his determination which, though of no utility, is at least interesting. If one looks at a standard candle from a distance of 1 meter, and if the pupil has a diameter of 3 mm., the energy entering the eye per second as light is so small, that it would require 1 year and 89 days to heat 1 gram of water 1° C. A more interesting figure would have been the power in watts or horse power which is consumed in the eye when one looks directly at the sun.

Unfortunately, the Tumlirz determination was based on taking the difference or the ratio of two measured quantities which are nearly alike. This is a method which should not be resorted to unless there is no better way, because a very slight error in either of the two measurements produces a very great error in the calculated quantity sought. His results are, therefore, probably not very accurate. A better way to determine this constant, or constants, if there are several, would seem to be to use a source of cold light, such as that produced by phosphorescence or vacuum tubes, convert a known part of it into heat and then measure this heat. Or, to use an ordinary source of light and filter out the heat rays (if any means for complete filtration exist), and then convert the cold light rays into heat which can be measured, as Thomsen did. The quantity desired will then be measured as a whole, and not as a difference between two measurements which are nearly alike, and the error would then be much less if no new sources of inaccuracy are introduced thereby.

Very little seems to have been published on this subject of the mechanical equivalent of light, but it may be of interest to compare a few other figures which have come to the notice of the writer.

The *Philosophical Magazine* of 1865, vol. 30, series 4, p. 429, contains an article by Julius Thomsen on the mechanical equivalent of light, and it appears to be the same one to which Tumlirz referred in his second paper. The method used was to measure by means of a thermopile the total radiation (heat and light) from a spermaceti candle burning 8.2 grams per hour (this measurement does not seem to enter into the calculation); he then measured that part due to the light alone, by absorbing the heat rays in a layer of 20 cm. of water, which he says completely absorbed them. The readings of the thermopile were calibrated by using a bulb of warm water in place of the lamp, the heat radiation of which could be calculated from Dulong's law. He thus finds that 1 kilogram-meter in a second is equal to 34.9 times the energy of the luminous rays from a spermaceti candle burning 8.2 grams per hour. He adds, "This is the maximum of the mechanical equivalent of light, and it may possibly still be somewhat reduced by subsequent experiments."

Thomsen refers to this as the "radiation" from such a flame, and gives no limiting boundaries. It may, therefore, be assumed that this figure is for the total radiation in all directions, if this radiation in every direction is equal to that in the direction in which he measured it. In other words the result then refers to a unit spherical candle power, whether the ratio of the spherical to the horizontal for that flame was unity or not. Tumlirz in his deductions from Thomsen's figures makes this same assumption, as calculations will show.

With this assumption, about which there is little doubt, these figures may be compared directly with those of Tumlirz. The candle used by Thomsen was apparently the British standard, which consumes 120 grains, while 8.2 grams would be 126.5 grains. Correcting for this increased consumption, and for the ratio of the Hefner to the British unit, makes the Hefner unit equal to 0.83 of that used by Thomsen. Thomsen's mechanical equivalent reduced to spherical Hefner units then equals 0.236 watt as the power for one spherical Hefner candle. Tumlirz's corresponding figure is 0.188, showing a very fair agreement, considering the difficulties involved in the measurements, especially as Thomsen merely claims his figure to be the maximum value.

Prof. Ebert, a well known German physicist, is reported to have stated that a single horse power would be sufficient to operate 46,000,000 Puluj lamps of 16-candle power. This means 7.36×10^{8} candles per horse power. As that lamp consists of a piece of mica painted with sulphide of calcium and subjected to the action of cathode rays in a vacuum, it would not be correct to assume that this is expressed in sperical candle powers. Let us suppose the spherical candle power was only a tenth of the horizontal, which is surely favorable to his figure, it would then reduce to 7.36×10^{7} spherical candles, while, according to Tumlirz, it would be only 4×10^{5}, which is only about one twenty-thousandth of Ebert's figure. The discrepancy is rather large, and if Ebert's figures are at all reliable, Tumlirz's mechanical equivalent of light is far too large.

H. Ebert, presumably the same physicist, in an article on light from Electric Oscillations (see *Electrical World*, Nov. 3, 1894, p. 467), describes a "luminescent lamp," which gave $\frac{3}{10}$ to $\frac{1}{10}$ of a Hefner candle and consumed about 1 millionth of a watt, the latter being calculated, as he says it was too difficult to measure it directly. If this referred to spherical candle power the mechanical equivalent for a spherical candle would be 0.00003 to 0.00004 watt, as compared with Tumlirz's figure, 0.188. The difference is again very great. Judging from the illustration of that lamp the spherical candle power may have been about $\frac{1}{8}$ of the horizontal, which would make his figure 0.00024 to 0.00032 watt.

Dr. Lodge, the distinguished English physicist, is reported to have said that at 100 per cent. efficiency one man turning a crank could develop sufficient energy to light a whole city. Assuming a man power to be $\frac{1}{8}$ of a horse power, he would, according to Tumlirz's figures, generate about 500 spherical candles, or 1,000 hemispherical, which would not be a very brilliant illumination for a city. According to this, the Tumlirz equivalent is again much too great.

The new arc lamp referred to at the beginning of these notes is one recently described by Rasch,[1] in which the arc is produced between two electrodes of magnesia, or other similar material, usually an oxide, including some of those of the rare earths, which is rendered conducting by heat, as an electrolyte, like in the Nernst lamp. He found that the efficiency increased with the input, reaching a maximum at 5.21 Hefner amylacetate candles per watt, after which it diminished again, the electrodes then becoming liquid. This figure approaches very closely to the corresponding equivalent determined by Tumlirz, namely 5.3 candles per watt, which would indicate an efficiency of very nearly 100 per cent. The latter figure is, however, based on spherical candles, while Rasch seems to base his figure on the horizontal candle power. The necessary correction might diminish this efficiency by nearly 50 per cent. The ideal lamp of 100 per cent. efficiency has, therefore, not been reached by him, as he claims, although even when corrected his efficiency seems to be far above that of commercial lights, and his experiment is, therefore, of interest. Whether his lamp can be made commercial seems still very doubtful. But even if not, it may be of considerable scientific interest in connection with the theory of the arc lamp. That the efficiency could not be 100 per cent. as claimed, is also evident from the fact that energy must be spent in volatilizing the electrodes, which are consumed, and considerable free heat is also developed, not only in the arc but in the electrodes as well. This must reduce the efficiency very greatly, for even if the Tumlirz equivalent is only approximate, it shows what has been generally known—that the mechanical equivalent of light is very small, or, in other words, that a small amount of heat or work corresponds to a large amount of light. Any light approaching an efficiency of 100 per cent. must, therefore, be cool, if not very nearly at the surrounding temperature, and if it is not so, one may be sure, even without a knowledge of the exact value of the mechanical equivalent of light, that the ultimate has not been reached.

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, ENGLAND, April 10, 1901.

Incandescent Gas Lighting.—Two Wild Goose Chases.—Why Not Tax Poisons.

Some facts relating to the use of incandescent gas lights in mills and places where they are subject to the vibrations due to machinery in continual operation, have recently been published in the correspondence columns of the *Gas World*, and the testimony thus afforded is particularly valuable at present, when several different parties are interested in minimizing the value of this system and the extent to which it has been adopted. The electricians, having found that it is an effective competitor with electricity in the domain not only of ordinary but also of high class lighting, and that many persons, after trying electricity, have gone back to the Welsbach, not merely on the score of

1. *Electrical World and Engineer*, March 9, 1901, p. 341, *Elektrotechnische Zeitschrift* Feb. 14, 1901, p. 155. See also the reply of Nernst, same journal, March 21, p. 256.

economy, but because they require brilliant, effective lighting, fall back on the old established procedure of "No case, abuse your opponent." Then there are those who, under the erroneous view that they are protecting the interests of gas consumers, endeavor to add to the obligations of gas companies by straining the Acts of Parliament relating to testing gas for illuminating power into a form that was obviously never intended in the first place. It does not suit their policy to recognize the fact that the incandescent is steadily eclipsing the flat flame burner. And parties interested in the sale of cannel and other enriching agents, foreseeing that the success of the incandescent system is not likely to increase the demand for these commodities, are apt to make the best, or rather the worst, of its defects, and to treat it as scarcely worthy of consideration in connection with the supply of gas for lighting. But the practical men who actually come in contact with the users of gas tell a different tale. They know that the incandescent system has caught on and is already used to nearly as large an extent as the flat flame. The evidence above alluded to is strongly in favor of that conclusion.

Mr. Allan, of the gas works, Nelson, Lancashire, states that last year he fitted up two dozen incandescent burners as an experiment in a mill where 1,300 looms were at work, and anyone who has visited a loom shed will see that they were not likely to get much consideration in the matter of vibration. But the result was so satisfactory that at the commencement of the past winter the whole mill was so lighted, 400 incandescents replacing 800 flat flame burners. After being in use for the whole lighting season, viz., from October to March, the installation had proved to be an entire success, only 60 mantles having been required during that period for renewals. And not only was there great economy in consumption of gas, but a very superior light. Mr. Stenhouse, of Fife, Scotland, writing as a user, states that in his power loom factory, where the vibration is considerable, the renewals average two mantles per annum. Mr. W. Honeyman, another user, says that even where the vibration is considerable the breakage of mantles is low and that altogether the test is in favor of the new system. The cost of mantles for renewals is but a trifle and there is a superior light. These remarks support a previous observation to the effect that the cost of maintaining an incandescent gas burner in efficient order is less than that of maintaining an electric glow lamp.

According to the findings of the portable photometer, as manipulated by the officials of the London County Council, the gas consumer who lives next door to an official testing station gets more for his money than one who is at the other end of the district. The average of 24 testings in the area supplied by the South Metropolitan Gas Company was 14 6 candles, of which two we e over 17, two over 15, fifteen over 14, and five over 13 candles, and it was pointed out that the high results were attained within a comparatively short distance of one of the fixed official testing stations. From this the conclusion is drawn that the Company have some means of sending a better article for the use of the Parliamentary gas examiner than is supplied to the bulk of the consumers. As a remedy, the Council propose more testing stations, and also that the Board of Trade be stirred up. The gas consumers will, therefore, be saddled with further expenses on account of gas testing, and the Board of Trade, who received a request some months ago from the Council, asking that an inquiry might be instituted with a view of explaining the difference in the results obtained by the official gas examiners as compared with those recorded by the Council's examiners, but have not taken any steps in the matter, are to be further stimulated by a repetition of the request. Probably the Board of Trade see that the portable photometer protests too much. The official testing stations have been so located as to get a fair sample of the bulk of the gas supply, being in all cases situated in populous districts and supplied from some of the largest lines of main. The Company make no secret of their supply system, but maps of the same are available for the use of the Referees. So the absurdity of the offensive charge against the Gas Company, which is nothing short of an accusation of deliberate fraud, must be apparent to all who have any practical knowledge of the subject. The other explanation, that a gas which passes muster in the principal mains as over 17 candle, falls to 13 before reaching the extremities of the district, is equally ridiculous. Where does the missing illuminating power go to? Such a stripping of the gas would mean the deposition, in the mains of the Company, of something like a gallon of fluid from each 1,000 cubic feet of gas. The most reasonable explanation of the divergent results obtained from practically the same article is that either the portable photometer itself or the methods of using it are at fault.

The corporation of Liverpool are also on a wild goose chase but in a different direction. The illuminating value of the gas supplied in Liverpool is beyond reproach, but the Company have taken up the manufacture of water gas, with the result that the minds of the city fathers are disturbed by the bogey of carbonic oxide and its poisonous properties. They have engaged the services of Dr. Kohn of the University College to make analyses, with a view of arriving at the percentage of carbonic oxide and presumably of water gas. That gentlemen has divided the city into three districts and the highest proportion of carbonic oxide found in samples from No. 1 is under 11 per cent. Of 7 samples from No. 2, two contained 18 per cent., and the highest result from 11 samples in No. 3 was just over 17 per cent. A special feature in No. 2 is that the proportion does not vary throughout the 24 hours, whereas in the other districts the larger proportion is sent out in the hours of daylight, during which period accidents are not so likely to occur. No. 1 is said to represent 18, No. 2, 47, and No. 3, 43 per cent. of water gas, and while Dr. Kohn is satisfied with the tests in No. 1 and No. 3, he is of opinion, bearing in mind that the danger attendant upon escapes of gas increases in a much greater ratio than the proportion of carbonic oxide, the mixture in district No. 2 is unnecessarily poisonous, especially during the night. The doctor's reasoning is somewhat obscure. If the danger increases in a much greater ratio than the percentage of carbonic oxide, it follows that there must be a point at which the gas, though containing perhaps only 50 per cent. of carbonic oxide, becomes more dangerous than the pure unadulterated substance. The doctor's opinion appears to be simply a sop thrown to the cerberus of the opinion entertained by a small section of the public in Liverpool, who are in favor of limiting the supply of water gas.

It would be a good plan to put a tax on poisonous substances present in articles of food or general use. Certainly strong poisons have their uses in medicine and in the arts, but they are not essential constituents of food stuffs, beverages or wearing apparel. If found to be contained in articles of this character there is no reason why the manufacturer should not be mulcted in a substantial contribution to the revenues of the country. There has been a great scare lately, on the subject of arsenic in beer. This objectionable element has been found to be present in our national beverage in sufficient proportion to occasion widespread disease and even death, and the subject is regarded as of such importance that a government commission has been appointed and is now sitting to inquire into the matter. It is a reproach to our elaborate system of regulations for the detection and prevention of adulteration and of sanitary inspection that this matter of such grave import to the welfare of the community at large, should have gone undiscovered for a century or more, and I cannot but think that if there had been a tax on arsenic or other extraneous substances in beer the government excise officers would have found it out many years ago. There is a proof of the red tape character not only of the researches of public analysts, but of manufacturing chemists in the events that have led up to the present scare. Brewing has long been known as a highly scientific process in which the microcope and the chemical laboratory were largely concerned. The constituents present in the water used and the nature of the yeast fermentation have been the matter of elaborate research. And yet no one appears to have observed the presence of a metal that is most easy of recognition. The immediate cause of the trouble does not concern us, and it is sufficient to note that it was brought about by the use of materials other than orthodox malt and hops. But a side issue of the inquiry has brought out the suggestion that it is very difficult to prepare malt that is absolutely free from arsenic.

Small traces of that metal are said to be present in the coal or coke used for drying the barley, and to be precipitated on the malt during the process of production. And gas coke has been pitched upon as a particular offender, with the result that it is now in bad repute amongst maltsters, and some gas companies who depended largely upon supplying that class of trade find themselves suffering considerable embarrassment by the sudden closing of an important outlet for their product. One would imagine that it was scarcely possible for gas coals to contain appreciable quantities of arsenic without the same becoming unpleasantly evident at the gas works. Arsenic volatilizes below a red heat and therefore one would expect that, so far from remaining in the coke, it would give some evidence of its presence in the ascension pipes and condensing apparatus. But there is no record of arsenic poisoning at gas works, or of the detection of arsenic in coal gas. Gas coke has been used in malt houses for nearly a hundred years, and up to within the last few months no maltster would have hesitated about using it if the prices, as compared with other fuels, were right. And one may be excused for suggesting that it would be more to the point if the brewers, instead of giving gas coke a bad character, were to refrain from the use of certain cheap but artificial substitutes for malt.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

MR. J. G. LIGHT, heretofore Superintendent of the Hillsdale (Mich.) Gas Company, has been appointed Superintendent of the Princeton (Ills.) Gas Light Company.

WRITE to the Laclede Firebrick Mfg. Company, of St. Louis, Mo., for a copy of the Company's catalogue. It reflects good credit on and to those who designed it.

WE are indebted to President Hickenlooper and Secretary Sage for an official copy of the notification issued by them to the shareholders of the Cincinnati Gas Light and Coke Company, respecting the contract whereby the latter is to assume full charge of the lighting of Cincinnati from central stations. The meeting is to be held the 6th prox. As said before in the JOURNAL, the name of the Company that will operate is to be that of the Cincinnati Gas and Electric Company, and the capital of the successor is to be $28,000,000. Good for the General.

MR. E. C. WHITE, who for some time was in charge of the Asbury Park station of the Consolidated Gas Company, of New Jersey, has been appointed Superintendent of the Winston Salem (N. C.) Gas Company.

MR. F. S. BENSON (he is a son of Col. F. S. Benson, Chief Engineer, Brooklyn Union Gas Company, Eastern Division) has been appointed Superintendent of the gas division of the properties of the Elmira (N. Y.) Light, Water, etc., Company.

THE United Gas Improvement Company seems to be doing some work, as the following contracts for the installing of its sets of standard, double-superheater Lowe water gas apparatus, received since the 1st of the year, will show—the total output from the named places amounts to 23,500,000 cubic feet per diem. New York city; San Francisco; Pawtucket, R. I.; Newton, Mass.; Norwich, N. Y.; Salisbury, N. C.; Nazareth, Pa.

SOME time this month we were in receipt of notification, from Messrs. Humphreys & Glasgow, of New York and London, that "Owing to insufficient accommodations at their present address, they will, on and after November 30th, 1900, occupy the first floor of Members Mansions, 38 Victoria street, Westminster, S. W." It looks, perhaps, that our notice of the change is something out of date; but our letter thereon is postmarked, "London, April 4th, 1901."

THE Keystone Meter Company, of Royersford, Pa., has printed a pretty and peculiar spring letter sheet, in that the titling of the sheet carries in its lettering a gas meter the way to which is strewn with violets.

MR. RALPH WOODWARD, for a long time in charge of the American Gas Company's property at New Rochelle, N. Y., or until that plant was absorbed by the Westchester Lighting Company, has been employed by the American Gas Company to oversee and direct the construction of the new plant for the Pittsfield (Mass.) Coal Gas Company that is to be constructed by the American Gas Company.

AT the annual meeting of the Savannah (Ga.) Gas Light Company the officers chosen were: Directors, A. R. Lawton, W. M. Low, J. C. Rowland, H. H. Gilmer, J. Rauers, J. H. M. Clinch, C. S. Connerat and J. F. Mints; President and Treasurer, A. G. Guerard.

AT the annual meeting of the shareholders in the Rochester (N. Y.) Gas and Electric Company the officers chosen were: Directors, J. Lee Judson, Wm. Runkle, F. Cook, G. W. Archer, A. H. Harris, G. A. Hollister, G. C. Hollister, W. S. Johnston, H. L. Brewster, John N. Beckley, G. A. Redman, W. L. Cole and C. B. Judson; President, J. Lee Judson; First Vice-President, F. Cook; Second Vice-President, Wm. Runkle; Treasurer, George W. Archer; Secretary and Assistant Treasurer, W. L. Cole; Attorney, A. H. Harris. The Company seems to have a numerous official staff.

THE Grand Island (Neb.) Gas Companyy has arranged for the installing of an electric lighting plant, the President of the concern (Mr. H. G. Leavitt) insisting that such a step should be taken.

NOT long ago the authorities of Brockville, Ont., purchased the plants of the Brockville Gas and Electric Light Company for operation on public account. Now the authorities propose to expend something like $25,000 to put the plants in shape.

QUITE some addition is being made to the generating house of the Worcester (Mass.) Gas Light Company.

MR. THOMAS COFFEY has completed the details of payment connected with his purchase of the Paducah (Ky.) Gas Company.

A NEW schedule of selling rates has been put out by Mr. W. T. Morris, President of the Penn Yan (N. Y.) Gas Company. The concession amounts to about 12 per cent. all round, and goes into effeot June 1st.

THE amended title to the Freeport (Ills.) Gas Light and Fuel Company is that of the Freeport Gas Light and Coke Company.

MR. JAMES F. HUNNEWELL, President of the Charlestown (Mass.) Gas Company, is again at his desk, chipper and smart, after a trip in the Soudanese district. His wife was with him during the traveling.

THE Woodland (Cal.) Gas and Electric Company has succeeded to the properties of the Woodland Consolidated Electric Light, Gas and Power Company. The title sounds a bit like simplification.

MR. J. H. MAXON, formerly in charge of the plants of the Gallipolis (O.) Gas and Coke Company, has been appointed Superintendent of the Coshocton (O.) Light, Fuel and Power Company.

MESSRS. R. D. WOOD & CO., of Philadelphia, are to construct a new holder for the Amesbury and Salisbury (Mass.) Gas Light Company. The Company badly needed such a structure in its trading.

A CORRESPONDENT incloses the following, from a recent issue of the South Norwalk (Conn.) *Sentinel:* "Users of illuminating and fuel gas in South Norwalk will be pleased to learn that the price of gas has been reduced, and that the drop was made on the 1st of April by the Connecticut Lighting and Railway Company. The former price for illuminating gas was $2 per 1,000 cubic feet with a 10 per cent. reduction for a payment on or before the 10th of the month. The former cost of fuel gas was $1.50 per 1,000 feet, with a 10 per cent. reduction for payment on or before the 10th of the month. The rates now for illuminating purposes are $1.70 per 1,000 feet, with 10 cents per 1,000 feet off for payment on or before the 10th of the month. The net price is $1.60 per 1,000 feet. The price on fuel gas has also been reduced from $1 50 per 1,000 feet to $1.35 for the same number of feet, with 10 cents per 1,000 off for payment on or before the 10th of the month, making the net price $1.25 per 1,000 feet. This reduction means that fuel and illuminating gas is within the reach of everyone. Undoubtedly there will be an increase in the use of gas for cooking and heating purposes, as it will be much cheaper with the present price than coal."

AT the annual meeting of the Derby (Conn.) Gas Company the officers elected were: Directors, W. E. Downes, R. M. Bassett, Thomas Wallace, C. E. Clark, W. H. Matthews, H. H. Wood, D. S. Brinsmade, F. E Hoadley and C. H. Nettleton; President and Treasurer, C. H. Nettleton; Secretary, Geo. H. Scranton.

A BRIDGEPORT (Conn.) correspondent sends this clipping from a late issue of the Bridgeport *Standard:* "At the annual meeting of the Bridgeport Gas Light Company very much more than one half of the shares had representation. The present Directors were retained in office, and the amendments to the Company's charter, which the Legislature passed recently, were unanimously approved. They empower the Company to increase its capital stock and to absorb the Citizens Gas Company. All matters of detail relating to the amendments were left entirely to the judgment of the Directors, who can act when they see fit. The Directors chosen were: W. R. Higby, W. B. Hincks, W. D. Bishop, A. J. Hobbs, E. G. Burnham, M. B. Beardsley, H. F. Greenman, N. W. Bishop and I. DeVer Warner—the latter fills the vacancy on the Board made by the demise of Samuel C. Trubee. The remaining Directors first appointed him to the place two months ago. The Directors subsequently met and chose Mr. Higby President. It was his 16th election to that office, his first election having been in 1886, after the death of Amos Treat. Frank B. Sammis was re elected Secretary and Treasurer, an office he has held for a number of years. (The record in office holders in the Company is Charles A. Gerdinier.) He was chosen superintendent of the works for the 38th consecutive year. Under his stewardship the works of the Company have grown from a

(*Concluded on page* 654.)

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
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AGENTS:

New York—American News Co. 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, APRIL 29, 1901.

(*Continued from page* 653.)

one building affair to cover a couple of acres of ground, Mr. Gerdinier came here from New York State. He is one of the best known men in the city, and for many years was chief engineer of the fire department. The Executive Committee appointed comprises William B. Hincks, H. F. Greenman and Morris B. Beardsley. Judge Beardsley and Mr. Greenman were appointed auditors. The report submitted by Treasurer Sammis was most gratifying to the stockholders. The finances of the Company are in excellent shape, and progress has been made during the year. The absorption of the Citizens Company is a matter of course, but when the older Company will make the move is still undecided. Negotiations to that end have been under way, but nothing definite has been done. The capital stock of the Bridgeport Company is $300,000 in $25 shares, while under the amendments to the charter it can be raised to $1,300,000 in shares of the par value of $100. The Company is also empowered to issue bonds to the amount of $1,000,000."

AT the annual meeting of the Columbus (Ind.) Gas Light and Coke Company the following officers were elected: Directors, Adam Keller, Wm. Brockman, H. Griffith, W. J. Lucas and C. M. Keller; President, A. Keller; Treasurer, Wm. Brockman; Secretary and Superintendent, C. M. Keller. It was decided to add considerably to the main system, the extension on such account this summer to be not less than 2 miles. Secretary Keller reports a good demand for gas ranges.

THE authorities of Canada have notified the Interior Construction and Improvement Company that the lease, whereby the latter has been enabled to convey natural gas to the United States through pipes on the bed of the Detroit river, will shortly be cancelled.

THERE is renewed talk of a gas works for Bedford, Ind., with responsible Cleveland, O., and Williamsport, Pa., parties mainly in interest.

THE proprietors of the Woodland (Cal.) Gas and Electric Company have acquired all the properties of the Consolidated Electric Gas and Power Company, of Woodland.

THE public lighting of San Francisco, Cal., for the last year was performed at a cost of $189,909.

MR. GEORGE L. THORNDIKE, for many years largely concerned with the business of the East Boston (Mass.) Gas Company, died at his home, Maverick Square, Boston, the morning of the 11th inst. He was born in Salem, Mass., November 9th, 1827, and served through the war of the Rebellion, being quite prominent in that conflict as Captain on the staff of General W. S. Hancock.

The Market for Gas Securities.

There was much animation in the dealings in city gas shares for the past week, and the trading in Consolidated was all done on a declining scale until to-day (Friday), when a fairly sharp recovery was made. Yesterday the extremes were 227½ to 223, with the closing at 226½. To-day the opening was at 226¾ to 227, with the closing at 227½ to 228. The main selling the last few days was for short account pure and simple, and it looks to us that the short side in Consolidated just now is the wrong side. The demand for Mutual continues, and our quotation of 350 to 360 is of the "strict" nominal order. Standards, common and preferred, are "wanted." Both of these should sell much higher in the near future. Investors should remember that the lighting supply of New York borough from central stations is absolutely under the control of the Consolidated Company.

Brooklyn Union is quoted well under its value this week. It was supposed that the meeting of the Consolidated Board to day would develop something in connection with the proposed amalgamation of the Consolidated and the Brooklyn Union, but it seems there was "nothing doing." Consolidated, of Baltimore, is steady, Peoples, of Chicago, is likewise, and Detroit gas shows a good advance.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

APRIL 29.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	227½	228
Central Union, Bonds, 5's.	3,000,000	1,000	106½	107
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	120	..
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	350	360
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	..	..	..
New Amsterdam Gas Co. .. Bonds, 5's	11,000,000	1,000	109	110
Northern Union, Bonds, 5's.	1,250,000	1,000	104	104¼
New York and East River.. Bonds 1st 5's	3,500,000	1,000	111	113
" 1st Con. 5's	1,500,000	..	106	108
Richmond Co., S. I.	348,650	50	70	..
" Bonds	100,000	1,000	..	..
Standard	5,000,000	100	130	132
Preferred	5,000,000	100	149	151
Bonds, 1st Mortgage, 5's	1,500,000	1,000	116	114
Yonkers	299,600	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	221	223
" " Bonds (5's)	15 000,000	1,000	118	119
Bay State	50,000,000	50	1	1⅛
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works,..	450,000	100	28½	32
" 1st Mtg. 5's	509,000	1,000	92½	95
Boston United Gas Co.— 1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	8	10
" " Bonds, 5's	5,250,000	1,000	75	76½
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	
Central San Francisco	2,000,000	..	106	108
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Cincinnati G. & C. Co.	8,500,000	100	199	199½
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	106	107
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	60	65
Preferred	3,026,500	100	84	86
Consumers, Jersey City Bonds	600,000	1,000	102	103
Consumers, Toronto	1,700,000	50	215	216
Consolidated, Baltimore	11,000,000	100	61¾	62
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's.	1,000,000	..	..	..
Equitable, 1st 6's.	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	12½	14½
" Con. Mtg. 5's	380,000	1,000	81½	83
Consolidated G. & E. Co.'s., Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co	4,825,500	50	90½	91½
" Prior Lien 5's	5,603,000	1,000	99½	100
Detroit Gas Co., 5's	381,000	1,000	..	89
" Inc. 5's	16,000	100	94	94½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	35	40
Fort Wayne	2,000,000	..	35	41
" Bonds	2,000,000	..	54	58
Grand Rapids Gas Lt. Co..	1,000,000	50	103	105
" 1st Mtg. 5's	1,225,000	1,000	..	..
Hartford	750,000	25	240	250
Hudson County Gas Co., of New Jersey	10,500,000	..	25	..
" Bonds, 5's	10,500,000	..	101	103
Indianapolis	2,000,000	..	55	60
" Bonds, 6's	2 650,000	..	94⅞	98
Jackson Gas Co	250,000	50	70	75
" 1st Mtg. 5's	200,000	1,000	101	102½
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	101½	103
Laclede, St. Louis	10,000,000	100	84	84½
Preferred	2,500,000	100	98	101
Bonds	10,000,000	1,000	108½	109
Lafayette Gas Co., Ind.	1,000,000	100	55	60
Bonds	1,000,000	1,000	56	58
Louisville	2,570,000	50	110	120
Madison Gas & Elec. Co.	400,000	100	62	68
" 1st Mtg. 6's	350,000	1,000	102½	108
" 6 per cent. scrip, due 1910	100,000	25	87	89
Montreal, Canada	2,000,000	100	182	184¾
Newark, N. J., Con. Gas Co	6,000,000	..	..	55
Bonds, 6's	4,600,000	..	..	103
New Haven	1,000,000	25	280	300
Nashville Gas Lt. Co.	1,000,000	50	110	..
Oakland, Cal.	2,000,000	..	46	47
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	113¼	116½
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	
Rochester Gas & Elec. Co..	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	47¼	47½
St. Paul Gas Light Co.	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	82	85
Extension, 6's	600,000	1,000	..	..
General Mortgage, 5's..	2,465,000	1,000	88	90½
St. Joseph Gas Co	1,000,000	100	36	39
" 1st Mtg. 5's	751,000	1,000	96½	98
Syracuse, N. Y.	1,750,000	100	17	18
Bonds	1,612 000	1,000	83½	9
Washington, D. C	2,600,000	20	30½	31⅜
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	100	100	101⅜
Bonds, 5's	4,000,000	..	106½	107½
Wilmington, Del.	600,000	50	200	201

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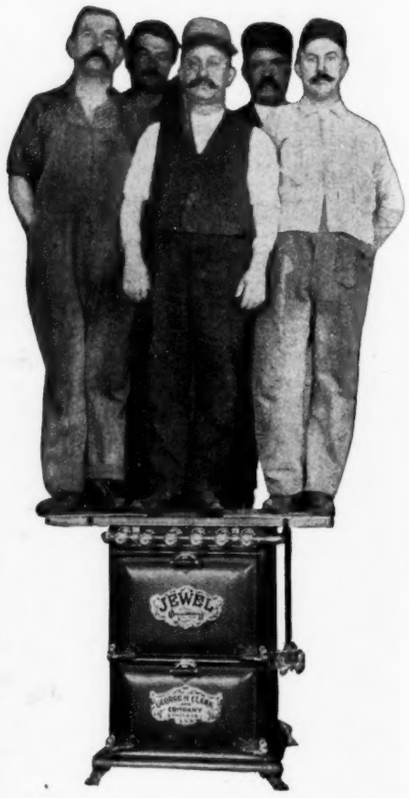

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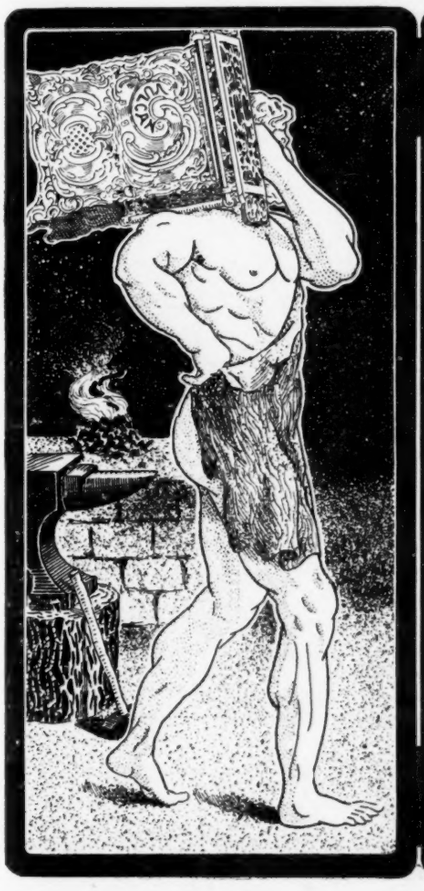

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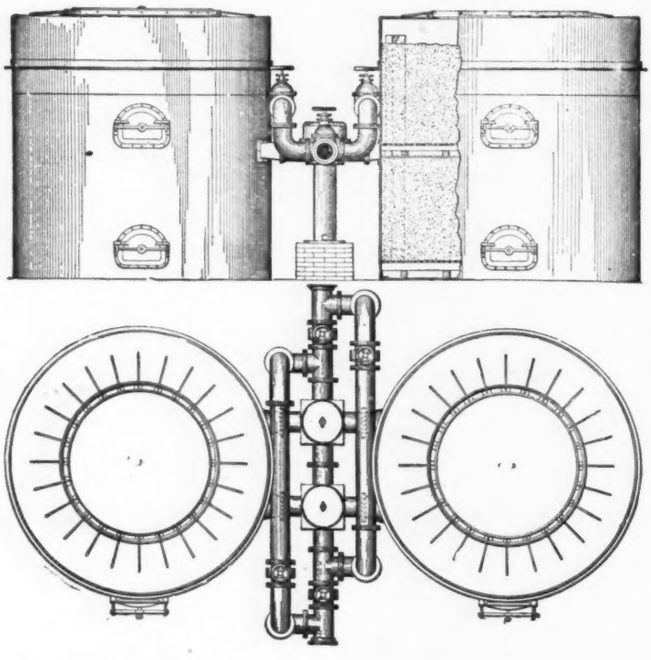

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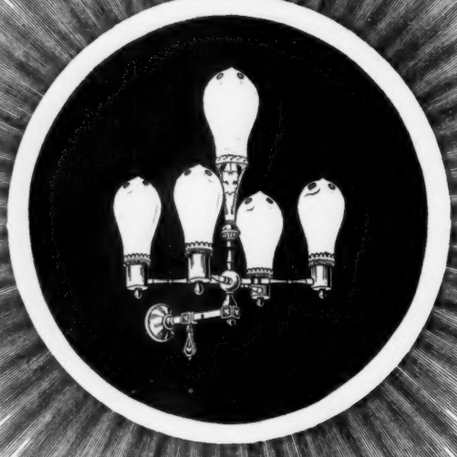

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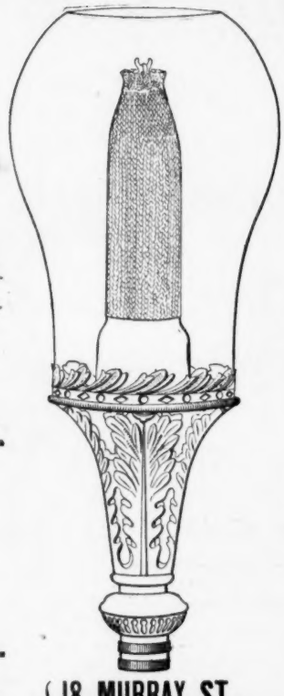

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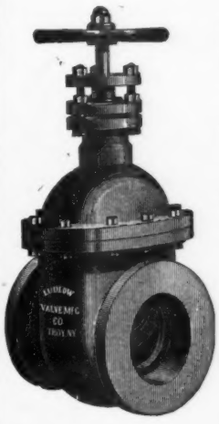

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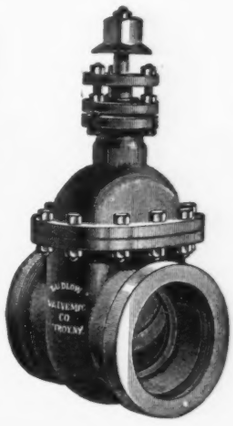

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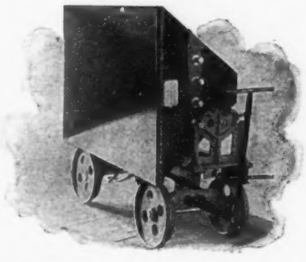
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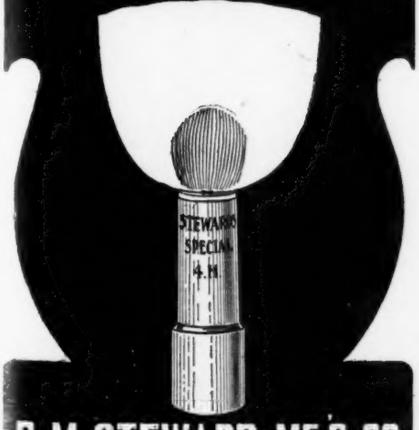

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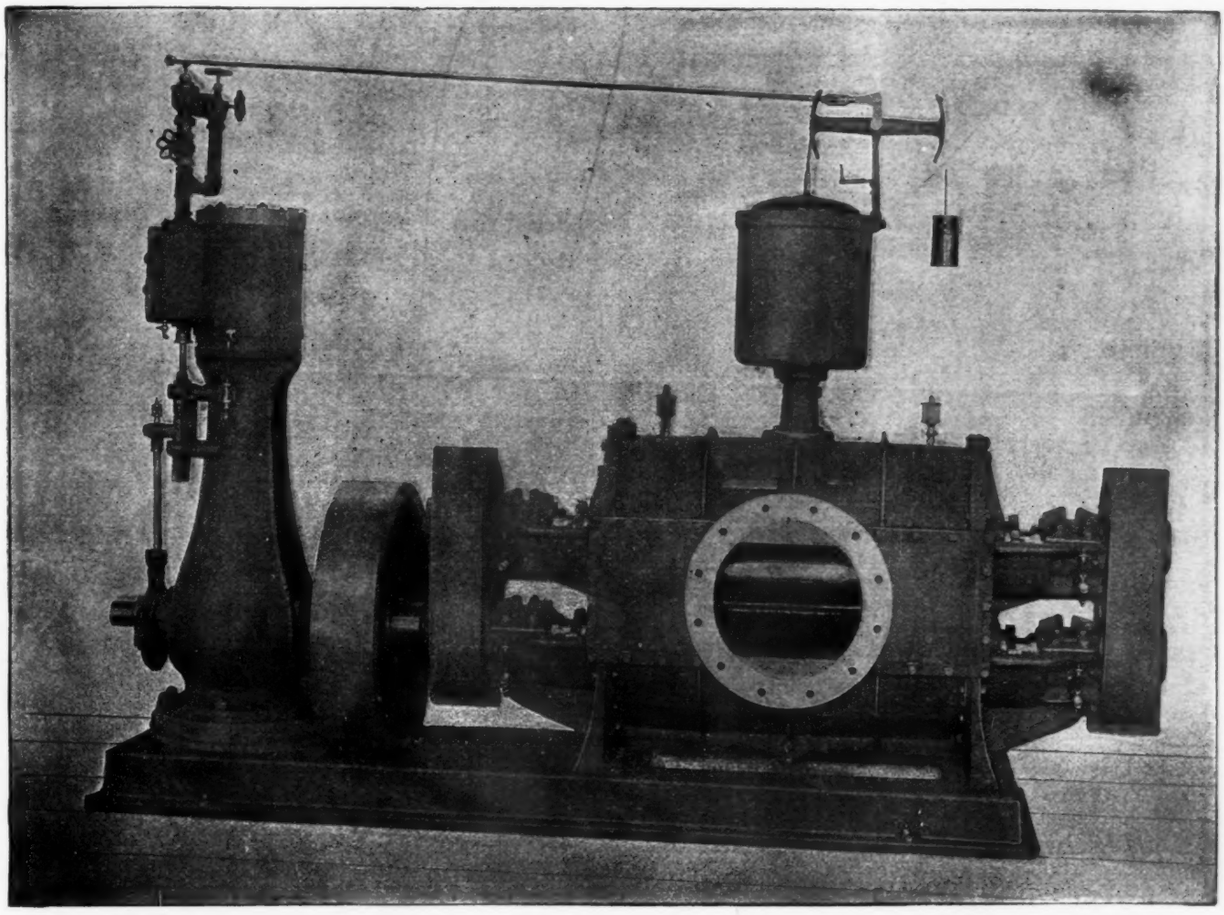

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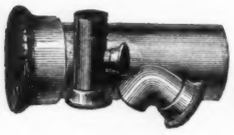

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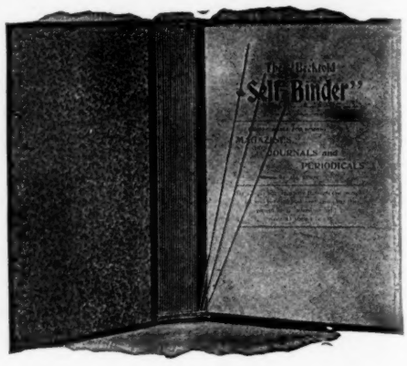

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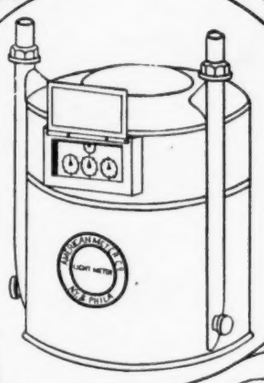

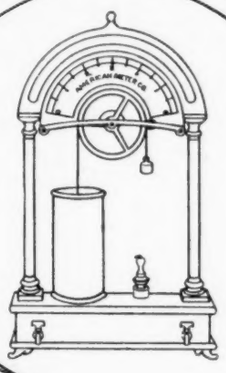

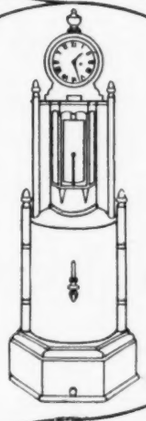

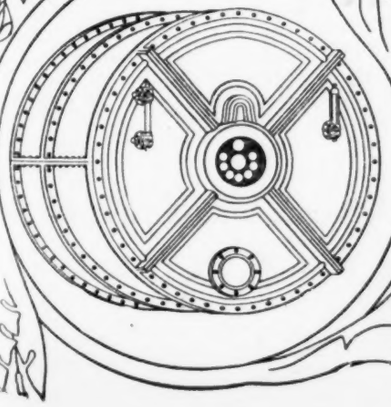

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CHICAGO, ST. LOUIS,

SAN FRANCISCO.

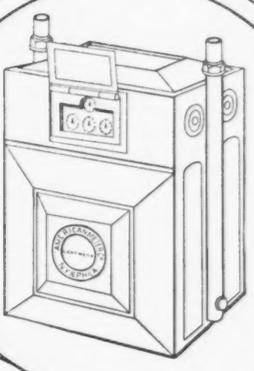
PUBLIC LIGHTING TABLE.

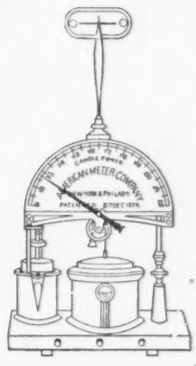
MAY, 1901.

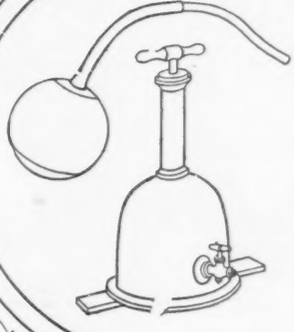
Day of Week.	Table No. 1. Following the Moon. Date.	Light.	Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Extinguish.
				P.M.	A.M
Wed.	1	3.10 AM	4.00 AM	6.45	4.00
Thu.	2	No L.	No L.	6.45	4.00
Fri.	3	No L. FM	No L.	6.45	4.00
Sat.	4	No L.	No L.	6.45	4.00
Sun.	5	7.30 PM	9.50 PM	6.45	4.00
Mon.	6	7.30	10.40	6.45	4.00
Tue.	7	7.30	11.30	6.55	3.40
Wed.	8	7.30	12.10 AM	6.55	3.40
Thu.	9	7.30	12.50	6.55	3.40
Fri.	10	7.30	1.30	6.55	3.40
Sat.	11	7.30 LQ	2.00	6.55	3.40
Sun.	12	7.40	2.40	6.55	3.40
Mon.	13	7.40	3.10	6.55	3.40
Tue.	14	7.40	3.40	7.00	3.30
Wed.	15	7.40	3.40	7.00	3.30
Thu.	16	7.40	3.40	7.00	3.30
Fri.	17	7.40 NM	3.40	7.00	3.30
Sat.	18	7.40	3.40	7.00	3.30
Sun.	19	7.40	3.40	7.00	3.30
Mon.	20	7.40	3.40	7.00	3.30
Tue.	21	7.40	3.40	7.10	3.15
Wed.	22	10.20	3.40	7.10	3.15
Thu.	23	10.50	3.40	7.10	3.15
Fri.	24	11.20 FQ	3.40	7.10	3.15
Sat.	25	11.50	3.40	7.10	3.15
Sun.	26	12.20 AM	3.30	7.10	3.15
Mon.	27	12.50	3.30	7.10	3.15
Tue.	28	1.10	3.30	7.15	3.15
Wed.	29	1.50	3.30	7.15	3.15
Thu.	30	2.20	3.30	7.15	3.15
Fri.	31	No L.	No L.	7.15	3.15

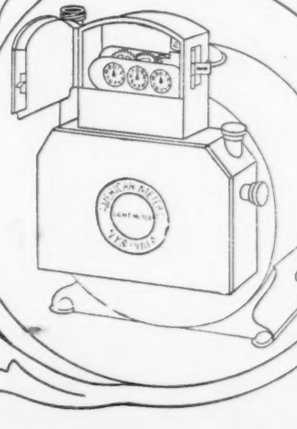
TOTAL HOURS LIGHTING DURING 1901.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	220.10	January	423.20
February	192.30	February	355.25
March	180.00	March	355.35
April	158.30	April	298.50
May	140.40	May	264.50
June	135.40	June	234.25
July	138.00	July	243.45
August	156.20	August	280.25
September	174.40	September	321.15
October	202.30	October	374.30
November	220.40	November	401.40
December	241.30	December	433.45
Total, yr.	2161.10	Total, yr.	3987.45









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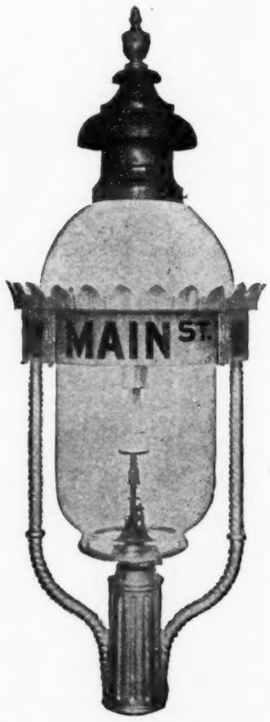

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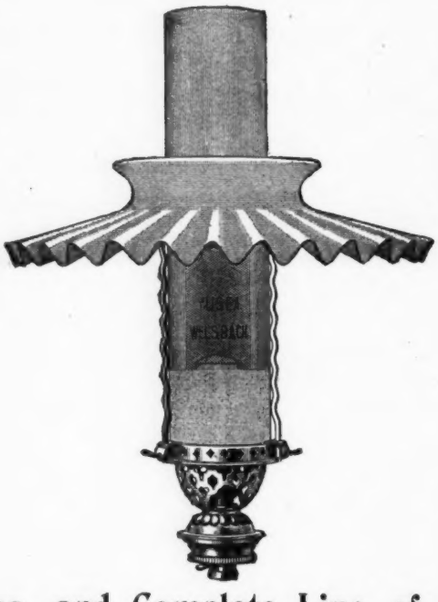

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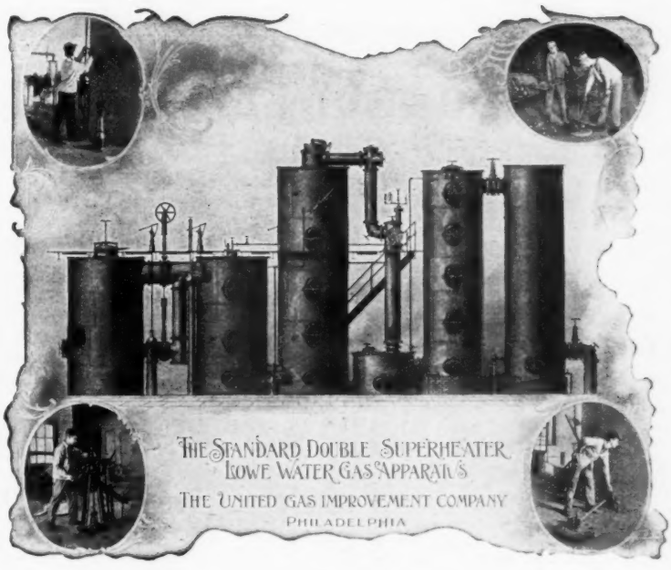
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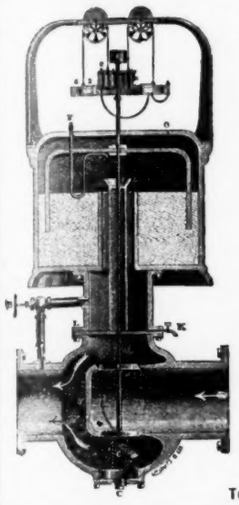

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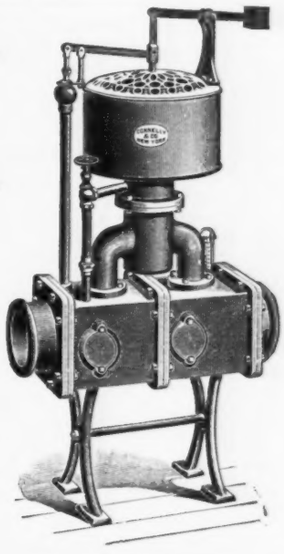

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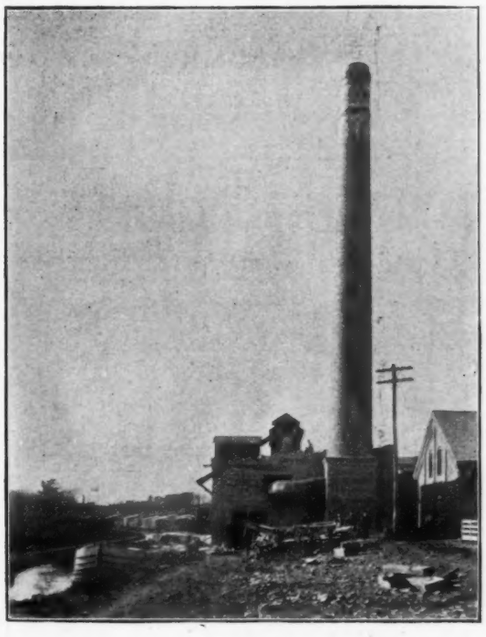

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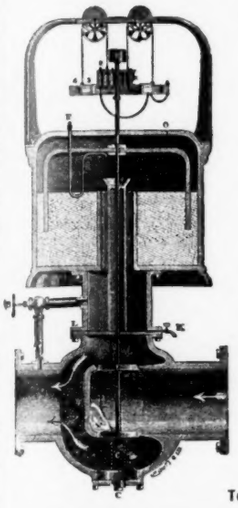

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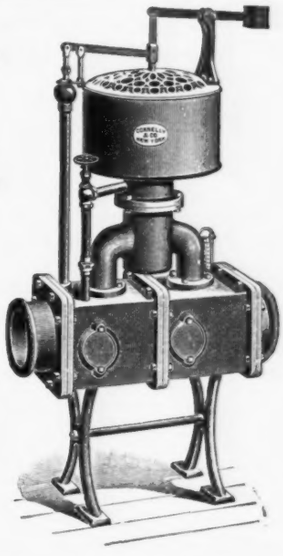

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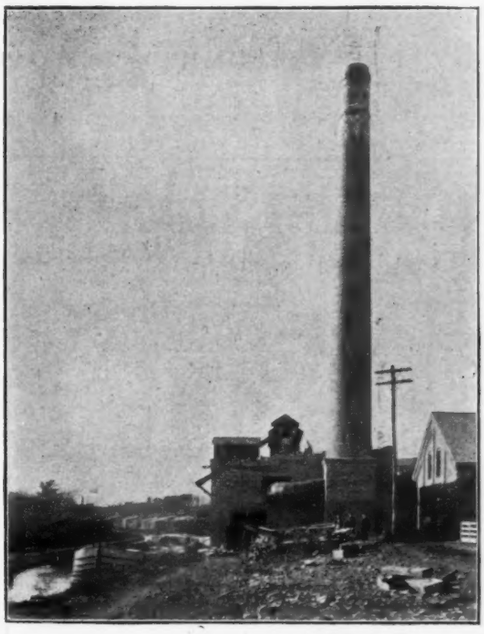

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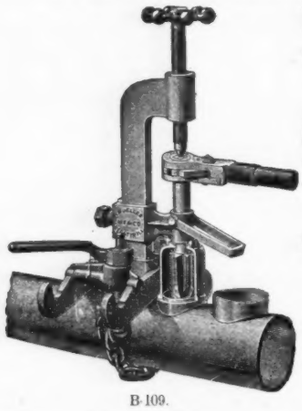

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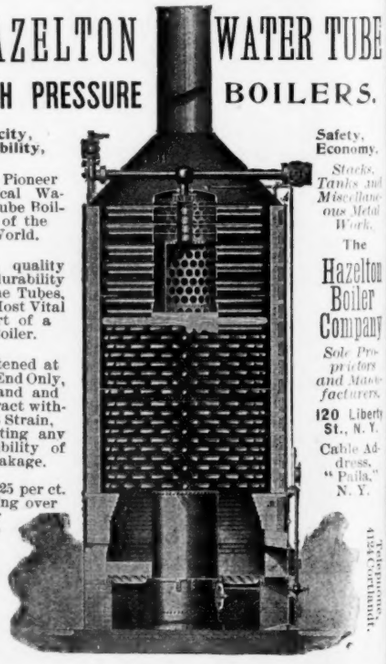

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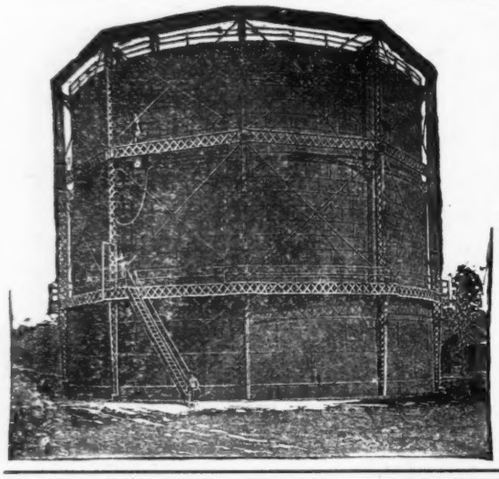

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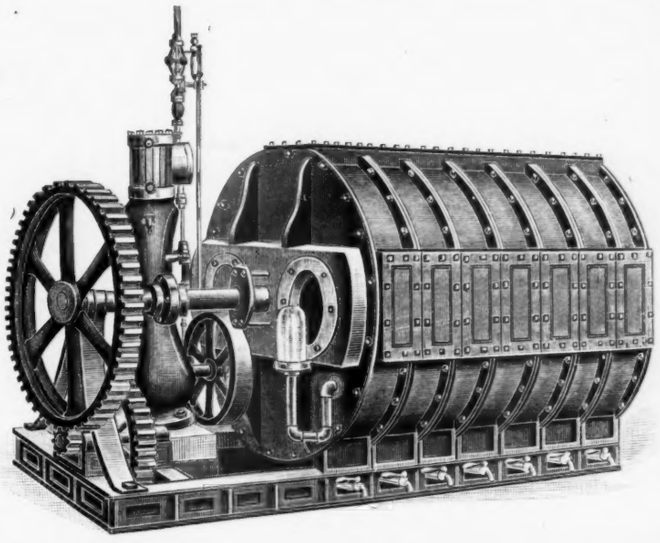

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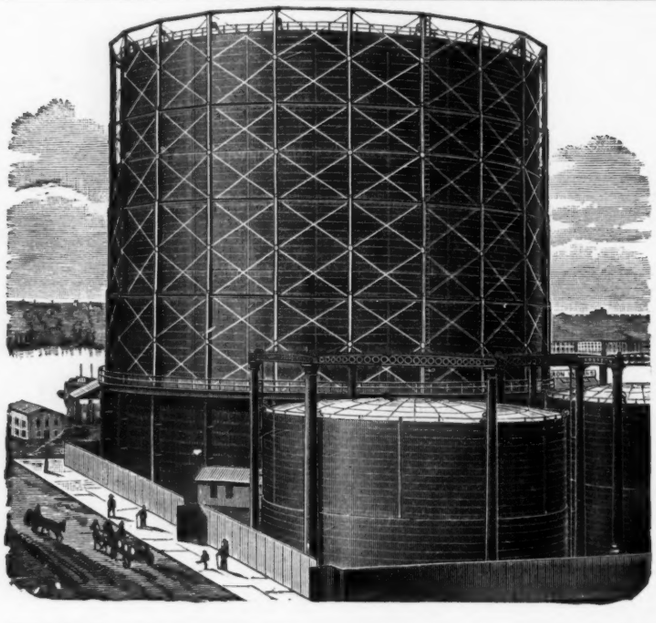

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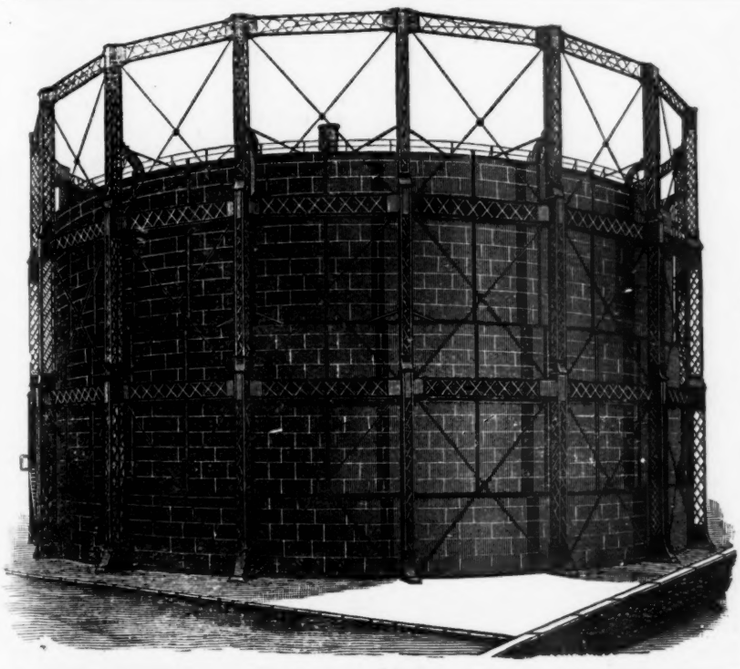

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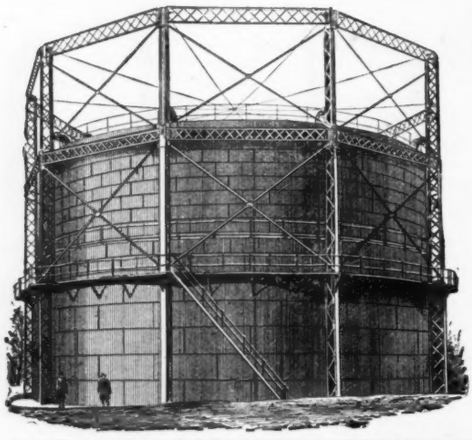

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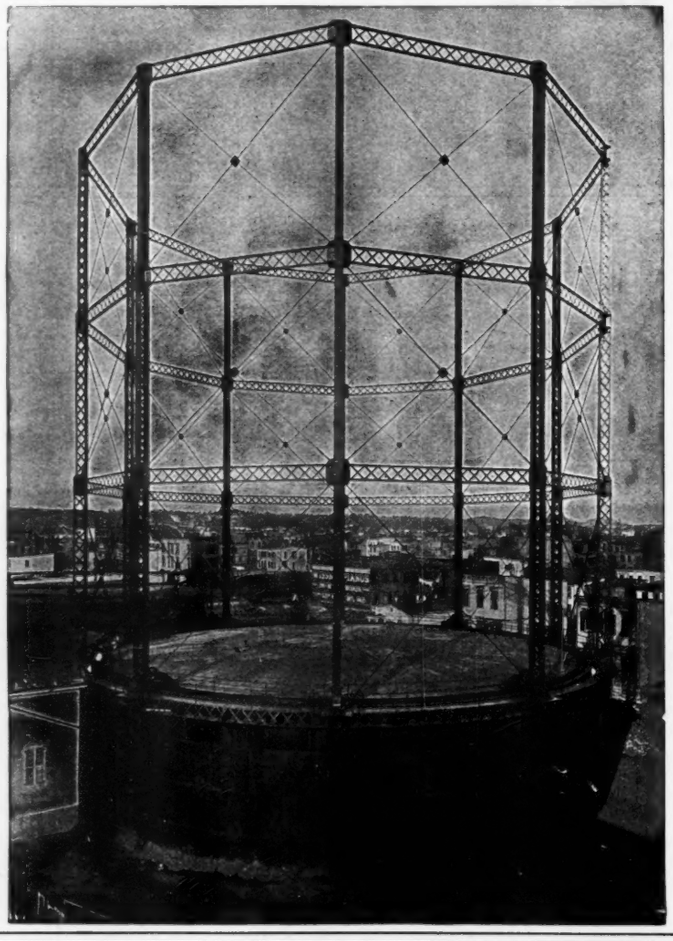

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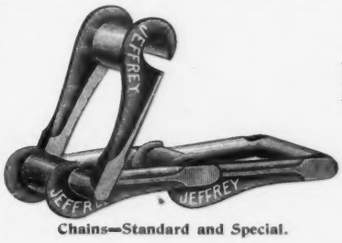

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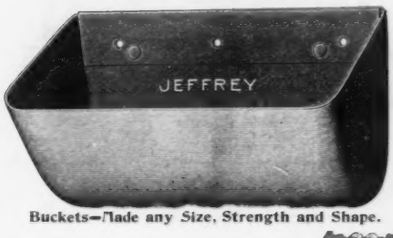

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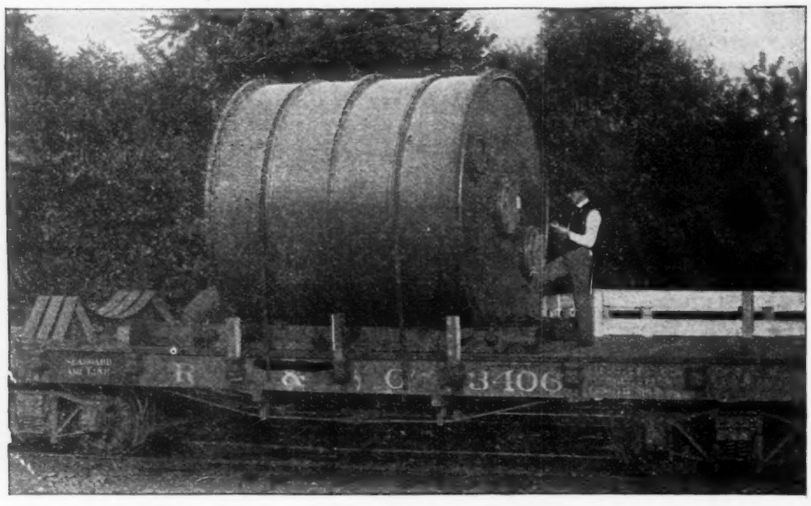

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